

Type ES45T


4.5-Meter ESA




4.5-Meter Earth Station Antenna

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DO NOT DISCARD CONTENTS



The product in this packaging was placed in the market after August 13, 2005. Its components must not be discarded with normal municipal or household waste.

Contact your local waste disposal agency for recovery, recycling, or disposal instructions.

Introduction

Like all Andrew earth station antennas, the 4.5-meter earth station antenna provides high gain and exceptional pattern characteristics. The electrical performance and exceptional versatility provides the ability to configure the antenna with your choice of transmit/receive as well as receive-only, and for either linearly- or circularly-polarized C-Band, linearly-polarized Ku-Band, Hybrid C-/Ku-Band or X-Band operation. Both pedestal and tripod mount types are available (motorization for pedestal only). The versatility is provided at the time of initial purchase, as well as in the future, as your satellite communications requirements evolve. This manual covers the manual Tripod only.

The segmented aluminum reflector panels are precision formed for accuracy and strength. The 6-piece reflector panel design ensures that the assembled reflector will maintain the extremely accurate surface contour and guaranteed performance without reflector alignment.

The versatile tripod mount features 164° of coarse azimuth coverage in four overlapping ranges, and 90° coarse elevation adjustment. This large range of adjustment provides the ability to view geostationary satellites from horizon-to-horizon, from any location within the continental United States. The broad mount leg spacing enable efficient load transfer to the foundation, providing additional mount rigidity.

The motorizable pedestal mount features self-aligning bearings for the elevation pivots, resulting in “zero” backlash. This mount can be operated manually, but has the potential to be upgraded for motorized operation, including steptracking/Smartrack™ applications. The motorizable mount type is indicated by the ES45MP or ES45MPJ letters within the antenna type number. The addition of the letter “J” within the antenna type number indicates that the mount includes azimuth/elevation machine jackscrews, instead of corresponding azimuth and elevation strut assemblies. The azimuth/elevation jackscrews are equipped for integration with the optional motor drive systems.

A manual pedestal mount is also available. It provides the same strong and versatile combination of mechanical features as the motorizable version; except that the elevation and azimuth axes are locking types, instead of bearing mounted types. This mount type is always equipped with manual struts and a fixed mount for the separately ordered combining network. This mount has been designed for manual applications only and cannot be upgraded to a motorizable mount.

The aluminum back structure and hot-dipped galvanized steel mount maintains pointing accuracy and ensures durability and reliability. The antenna and mount will survive 125 mph (200 km/h) wind, in any position of operation, without damage or permanent deformation.

Andrew provides a complete line of available options, including field-installable electrical anti-icing heaters, pressurization equipment and interconnecting HELIAX cables and waveguide.

An optional hoisting kit, which precludes the use of a crane, is available from Andrew and can be utilized as an installation tool for multiple installation purposes.

Proprietary Data

The technical data contained herein is proprietary to Andrew Corporation. It is intended for use in installation, operation, and maintenance of Andrew equipment. This data shall not be disclosed or duplicated in whole or in part without express written consent of Andrew Corporation.

Information and Assistance

Andrew corporation provides a world-wide technical support network.

Notice

The installation, maintenance, or removal of antenna systems requires qualified, experienced personnel. Andrew installation instruction have been written for such personnel. Antenna systems should be inspected once a year by qualified personnel to verify proper installation, maintenance, and condition of equipment.

Andrew disclaims any liability or responsibility for the results of improper or unsafe installation practices.

All designs, specifications, and availabilities of products and services presented in this manual are subject to change without notice.

Technical Assistance

24-hour Technical Assistance

For technical assistance, call the following numbers at anytime.

Call From	Call To	Telephone	Fax
North America (toll free)	U. S. A.	1-(800)-255-1479	(800)-349-5444
Any Location (International)	U. S. A.	(708)-349-3300	(708)-349-5410

Customer Service Center

The Andrew Customer Service Center gives you direct access to the information and personnel service you need, such as the following:

- Place or change orders
- Check price and delivery information
- Request technical literature

You can call from any of the following:

Call From	Telephone	Fax
North America	1-800-255-1479 (toll free)	1-(800)-349-5444 (toll free)
United Kingdom	00-800-0-255-1479 (toll free)	00-800-0-349-5444 (toll free)
Australia	0011-800-0-255-1479 (toll free)	0011-800-0-349-5444 (toll free)
China	00-800-0-255-1479 (toll free)	00-800-0-349-5444 (toll free)
New Zealand	00-800-0-255-1479 (toll free)	00-800-0-349-5444 (toll free)
Hong Kong	001-800-0-255-1479 (toll free)	001-800-0-349-5444 (toll free)

How to Use This Manual

Overview

The scope of this manual is intended to provide station personnel with the base installation (ie: mount, reflector and enclosure), operation and maintenance requirements necessary for a 4.5-Meter Earth Station Antenna.

Note: All antenna option instructions are included in the individual kit shipped with the part. This manual provides a convenient reference for authorized operator/service personnel requiring technical information on general system or specific subsystem equipment.

The tables and figures presented in this manual are used as communication aids for the installation, operation and maintenance of the 4.5-Meter Earth Station Antenna. These tables and figures instantly convey messages, as well as make the procedures easier to understand. This manual uses tables and figures for the following references:

- **Tables** The tables allow you to locate information quickly and easily.
- **Drawings** The drawings supplement the installation instructions by using a combination of graphics and verbiage to assist you in simplifying complex procedures and clarifying components
- **Photographs** The photographs complement the installation instructions by providing actual examples of the steps being performed, which allow you to view the installation in process.

Content

The manual is divided into five distinct sections, each dealing with a specific technical topic relating to either system or component subsystem information. The sections contained in this manual are described and listed under the following technical headings:

- **How to Use This Manual** Describes the manual's purpose, content, and communications aids. Additionally, this section lists the related documentation for the 4.5-Meter Earth Station Antenna.
- **Getting Started** Provides the preliminary information needed to perform a successful installation. This section should be reviewed prior to the installation. The warnings, recommended tools, parts verification, instructions on reporting lost or damaged equipment and installation checklist are located in this section.
- **Installation Procedures** Provides the procedures for the different phases of a 4.5-Meter Earth Station Antenna base installation. This section will help you easily find requirements for an individual task, as well as display the sequence for each tasks execution.
- **Operation** Describes the controls, functions, and general operating procedures required for proper operation of the 4.5-Meter Earth Station Antenna
- **Maintenance** Describes preventative maintenance procedures that are required to maintain proper functional operation of your new Andrew Earth Station Antenna.

Getting Started

Overview

The installation, operation and maintenance of the 4.5-Meter Earth Station Antenna requires qualified personnel. Andrew installation, operation and maintenance instructions are illustrated for such personnel. Additionally, the antenna should be inspected by qualified personnel to verify proper installation, maintenance and condition of equipment as described in Preventative Maintenance. The basic equipment and accessories are either manufactured or design controlled by Andrew Corporation.

The prerequisite information necessary for the 4.5-Meter Earth Station Antenna can be found in this section. Furthermore, this section should be reviewed before performing the installation, operation or maintenance. Warnings, recommended tools and the antenna parts can be verified and/or determined with such a review.

Warnings

When installing the 4.5-Meter Earth Station Antenna, be conscious of the warnings presented below. For further information or clarification of this information, contact the Customer Service Center at one of the phone numbers listed. The warnings are as follows:

1. Electrical shock from voltages used in this antenna system may cause personal injury or death. Prior to making any electrical connections or performing maintenance or repair, ensure that the power is removed. Electrical connections should only be made by qualified personnel in accordance with local regulations.
2. Installation of antenna may require persons to work at elevated work stations. Whenever persons are working at eight or more feet above the ground and not on a guarded platform, they should wear safety belts with at least one (preferably two) lanyards.
3. Never stand underneath any object while it is being lifted.
4. Always wear a hard hat, especially if someone is above you.
5. Make sure no person is in or under the reflector while it is being lifted or positioned; personal injury can result if the reflector assembly falls.
6. Personnel should never be hoisted in or out of the reflector by crane; personal injury may result.
7. Andrew earth station antennae supplied to standard product specifications will survive 125 mph winds in any operational position in moderate coastal/industrial areas. Severe conditions require additional protection. Should it be expected that winds will exceed 125 mph, it is recommended that Andrew antennae be steered to specific azimuth and elevation orientations to minimize wind forces upon the structure and thereby increase the probability of survival.
8. It is recommended that all cross axis-waveguide and coaxial cables are secure such that high winds will not cause excessive flexing. Position the antenna to an elevation of 90 degrees. The azimuth jackscrew should be placed in the center of its travel.
9. When the antenna is transmitting, severe eye injury or injury to other parts of the body can result from exposure to radio frequency (RF) energy. The antenna must be turned off before entering the area in front of the reflector and near the feed.

Note: Failure to follow an installation procedure could result in damage to equipment or personal injury.

Additional warnings will be displayed throughout this manual for your awareness. These warnings can be identified in warning boxes as shown in the following sample.



Andrew disclaims any liability or responsibility for the results of improper or unsafe installation, operation or maintenance practices.

**Recommended
Tools**

Andrew supplies all appropriate hardware/parts required for the installation of your 4.5-Meter Earth Station Antenna. All tools necessary for the installation process should be provided by the installation crew. Andrew recommends that the following tools be used for a proper installation of the 4.5-Meter Earth Station Antenna.

Table 1. Recommended Tools

Tool	Size	Qty.
Open End Wrench	1/4"	2
	3/8"	2
	1/2"	2
	9/16"	2
	5/8"	2
	3/4"	2
	7/8"	2
	1-1/4"	1
Drive Sockets	7/16"	2
	9/16"	1
	3/4"	1
	7/8"	1
	1-1/16"	1
	1-1/4"	1
Spud Wrench	1-1/16"	1
Breaker Bar	1/2"	1
Screw Driver	Standard	1
	Phillips	1
Allen Wrench	1/2"	1
Tape Measure	Standard	1
Felt-tip Marker	Standard	1
Hammer	Standard	1
Rubber Mallet	Standard	1
Pry Bar	Standard	1
Tin Snips	Standard	1
Crane	1 Ton Minimum Capacity	1
Rope/Cord (2000 lb breaking strength)	50 ft	1
Shackles	5/8"	2
Ladder	10 Foot Extension	1
Nylon Web Sling	3" x 3'	2

Parts Verification

Upon receipt of your order, the shipment should be verified to ensure that all parts have reached your site. This process should occur before the installation process begins.

Andrew Corporation thoroughly inspects and carefully packs all equipment before shipment. If you find that there are missing components, please refer to step-by-step instructions on how to properly report the equipment loss.

When you have received your order, verify that all parts contained in the shipment correspond to the parts listed on your packing list.

Reporting Equipment Loss or Damage Reporting Visible Loss or Damage

If you find that the equipment was damaged during the shipping process, you should file a claim with the carrier. Follow the "Reporting Visible Loss or Damage" or "Reporting Concealed Damage" procedures when filing a claim with a carrier.

Make a note of any loss or evidence of external damage on the freight bill or receipt, and have it signed by the carrier's agent. Failure to adequately describe such external evidence of loss or damage may result in the carrier refusing to honor a damage claim. The form required to file such a claim will be supplied by the carrier.

Reporting Concealed Damage

Concealed damage means damage which does not become apparent until the unit has been unpacked. The contents may be damaged in transit due to rough handling, even though the carton may not show external damage. If you discover damage after unpacking the unit, make a written request for an inspection by the carrier's agent, then file a claim with the carrier since such damage is most likely the carrier's responsibility.

Inventory Equipment Received

After opening your shipment, you should take inventory of the parts immediately. Check each item received in your shipment against the packing slip included with the shipment. If any items are missing, please notify Andrew Corporation immediately by contacting the Customer Service Center at one of the phone numbers listed.

Returning Equipment

Andrew Corporation tries to ensure that all items arrive safe and in working order. Occasionally, despite these efforts, equipment is received that is not in proper working condition. When this occurs, and it is necessary to return the equipment to Andrew Corporation for either repair or replacement, return can be expedited by using the following procedure:

Step 1

Call the Andrew Customer Service Center and request a Return Material Authorization (RM) number, as well as the address to which you should forward the material(s).

Step 2

Tag or identify the defective equipment, noting the defect or circumstances. Also, be sure to write the RM number on the outside of the carton. It would be helpful to reference the Andrew sales order and purchase order number, as well as the date the equipment was received.

Step 3

Pack the equipment in the original container with protective packing material. If the original container and packing material are no longer available, pack the equipment in a sturdy corrugated box and cushion it with appropriate packing material.

Step 4

Be sure to include the following information when returning the equipment:

- Your Company Name
- Your Company Address City, State and Zip Code
- Telephone Number
- RM Number
- Problem Description
- Contact Name

Note: Absence of the RM number will cause a delay in processing your equipment for repair. Be sure to include the RM number on all correspondence.

Step 5

Ship the equipment to Andrew Corporation using UPS, U.S. Postal Service, or other appropriate carrier, freight prepaid and insured. The material should be forwarded to the address given by the Andrew contact in Step 1.



Installation Sequence Checklist

The 4.5-Meter Earth Station Antenna requires the installation team to perform the assembly in the sequence presented below. Moreover, this sequence should be reviewed beforehand to ensure a smooth installation. Use the following checklist to verify and/or determine the installation sequence. Throughout the checklist certain part numbers will be used. Those part numbers describe the antenna currently being installed. The ES45T-R is a receive-only 4.5-Meter Earth Satellite Antenna with a tripod mount. The ES45T-T is a transmit/ receive 4.5-Meter ESA with a tripod mount.

Site Preparation

Refer to Foundation Specifications for guidance in preparing the location and the installation of the 4.5-Meter Earth Station Antenna foundation.

Tripod Ground Mount Assembly

- Mount azimuth axis support and rear anchor pads
- Connect support angles
- Attach support and elevation pivot assembly to support angles
- Attach support angles to azimuth axis joint
- Hoist support and pivot elevation pivot assembly
- Fasten azimuth axis joints to azimuth axis support
- Attach elevation strut to azimuth axis joint
- Attach azimuth strut to appropriate rear pad

ES45T-R Main Reflector Assembly

- Remove protective covering from crate
- Pry top crate panel off
- Pry sides off crate
- Pry front off crate
- Unbolt reflector panels from bottom of crate
- Prepare assembly area with diameter setting bands and temporary supports
- Lay reflector segments on prepared assembly area
- Attach opposite segments to mounting ring hub and diameter setting bands
- Attach remaining segments to mounting ring hub and original panels
- Attach seam hardware to panels
- Attach retaining bar to mounting ring hub
- Tighten joining plates in concentric circles around reflector
- Attach feed strut brackets and feed struts

ES45T-R Back Structure Assembly

- Attach tee plates to reflector
- Attach plates to reflector
- Attach support angles to tee plates
- Attach support angles to plates
- Connect tee plates and plates with pivot brackets
- Connect tee plates with elevation axis bracket
- Connect pivot brackets to elevation axis bracket with support angles
- Tighten hardware with A-325 procedure
- Remove diameter setting bands

ES45T Reflector- to-Mount Assembly (With Crane)

- Wrap crane straps around angle between pivot brackets
- Align pivot brackets with support and elevation pivot assembly
- Connect pivot brackets with support and elevation pivot assembly
- Determine required length of elevation strut
- Connect elevation strut to elevation axis bracket

Feed Installation

- Attach feed struts to feed support
- Attach collar to feed horn assembly
- Install feed horn assembly into feed support
- Set dimension between center plate and feed horn

Tripod Ground Mount Assembly

- Mount azimuth axis support and rear anchor pads
- Connect support angles
- Attach support and elevation pivot assembly to support angles
- Attach support angles to azimuth axis joint
- Hoist support and pivot elevation pivot assembly
- Fasten azimuth axis joints to azimuth axis support
- Attach elevation strut to azimuth axis joint
- Attach azimuth strut to appropriate rear pad

ES45T-T Main Reflector Assembly

- Remove protective covering from crate
- Pry top crate panel off
- Pry sides off crate
- Pry front off crate
- Unbolt reflector panels from bottom of crate
- Prepare assembly area with diameter setting bands and temporary supports
- Lay reflector segments on prepared assembly area
- Attach opposite segments to mounting ring hub and diameter setting bands
- Attach remaining segments to mounting ring hub and original panels
- Attach reflector rib segments to panel seams
- Tighten seam hardware in concentric circles around reflector
- Install center plate and center pad to mounting ring hub
- Attach feed strut brackets and feed struts

ES45T-T Back Structure Assembly

- Attach tee plates to reflector
- Attach rib connecting plates to reflector
- Assemble support angles and pivot brackets for installation
- Install pivot bracket assemblies
- Connect pivot brackets with support angle
- Install two support angles to elevation axis bracket
- Connect pivot brackets and elevation axis bracket with support angles
- Tighten hardware using A-325 tensioning procedure
- Remove diameter setting bands

ES45T Reflector-to-Mount Assembly (With Crane)

- Wrap crane straps around angle between pivot brackets
- Align pivot brackets with support and elevation pivot assembly
- Connect pivot brackets with support and elevation pivot assembly
- Determine required length of elevation strut
- Connect elevation strut to elevation axis bracket

Feed Installation

- Attach feed struts to feed support assembly
- Assemble feed horn assembly to network
- Install feed assembly into feed support
- Tighten all collar set screws

Waveguide/Flex Section Assembly

- Attach flex section to feed assembly flanges
- Attach mounting brackets to feed struts
- Attach flex section to waveguide assembly
- Tighten all mounting hardware

Subreflector Installation

- Station two men inside reflector
- One man attaches subreflector to struts
- One man supports subreflector
- Tighten all strut hardware

Feed Installation

- Attach feed assembly to main reflector hub
- Install OMT inside feed assembly

Installation Procedures

Overview

This section provides installation procedures for the 4.5-Meter Andrew Earth Station Antenna. The installation procedures include instructions on the following antenna components.

- Mount
- Reflector
- Back Structure
- Reflector To Mount Assembly
- Subreflector
- Feed System

Note: All installation instructions for the antenna options are contained in the parts kit included in the shipment.

Foundation Preparation

Before beginning the installation process on the ground mount assembly, ensure that the foundation has been prepared. Foundation specifications are provided by Andrew and may be used as a reference by civil engineering personnel when preparing the foundation for local soil conditions. These specifications are available before the shipment arrives by contacting the Customer Service Center.

Sweep foundation clean of any dirt or debris.

To ensure level, smooth surface for mount, remove excess concrete from shear caps and anchor bolts as shown in Figure 1.



Figure 1

A-325 Tensioning

During the installation process there are several references to the A-325 hardware tensioning procedure. The A-325 hardware must be properly tensioned to avoid slippage between bolted surfaces under high loads. Slippage can cause the corresponding assembly to move, causing antenna misalignment. When designated, the A-325 hardware should be tightened according to the following tensioning procedure.

Note: Tensioned bolts are for final connections only and should not be loosened for reuse.

Step 1

Lubricate the bolt threads with the provided stick wax to reduce friction.

Step 2

Insert the bolt, and add a flat washer - if required. **Do not** allow wax under the flat washer.

Step 3

Add the nut and finger-tighten.

Step 4

After the connections are complete, tighten the bolts until the surfaces are joined and the nuts are snug (for example, full effort of a person using an ordinary spud wrench).

Do not proceed with Steps 5 and 6 unless the connection is final and is not intended to be loosened again.

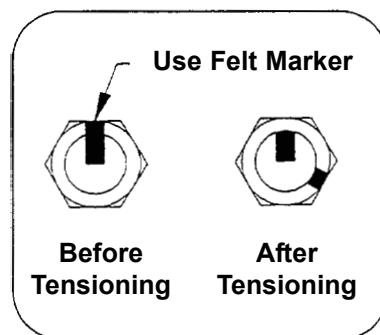
Note: If the bolts are loosened after Steps 5 and 6, discard and replace with new hardware.

Step 5

Using a felt-tip marker, mark the nuts and the ends of the bolts with a straight line as shown in Figure A-325.

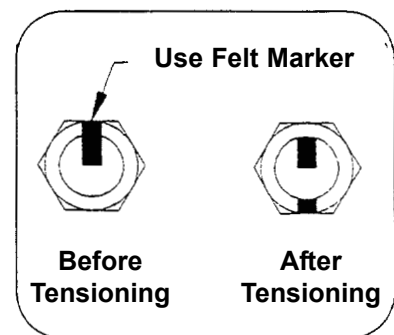
Step 6

Tighten the nuts further with an extra-long wrench until the nuts are moved 1/3 turn (120 degrees) as shown in Figure 1a **for bolt lengths shorter than four diameters** and 1/2 turn (180 degrees) as shown in Figure 1b **for bolt lengths longer than four diameters**.



For Bolts Shorter Than 4 Diameters

Figure 1a. A-325 Tensioning



For Bolts Longer Than 4 Diameters

Figure 1a. A-325 Tensioning

Note: Do not perform A-325 tensioning procedure during assembly process unless specifically designated by installation instructions. Final tightening will occur after mount is fully assembled.

Tripod Mount

The three-point mount in an elevation-over-azimuth configuration optimized for geostationary satellite applications. The mount enables standard elevation ranges from 2°-62°, and 33°-90° with high-look strut configuration. Azimuth range is $\pm 82^\circ$. Fine adjustment is provided in both azimuth and elevation. An example of the assembled tripod mount is provided in Figure 2.



Figure 2

Before assembling the mount, verify that all parts are present. Follow the subsequent procedures for proper installation of tripod ground mount assembly.

Step 1

Loosely attach azimuth axis support (P/N 49634) and rear anchor pads (P/N 300747) to foundation pads. Refer to Figures 3 and 4.

- Use $\frac{3}{4}$ -10 x 1- $\frac{1}{4}$ in. hex nuts and washers



Figure 3

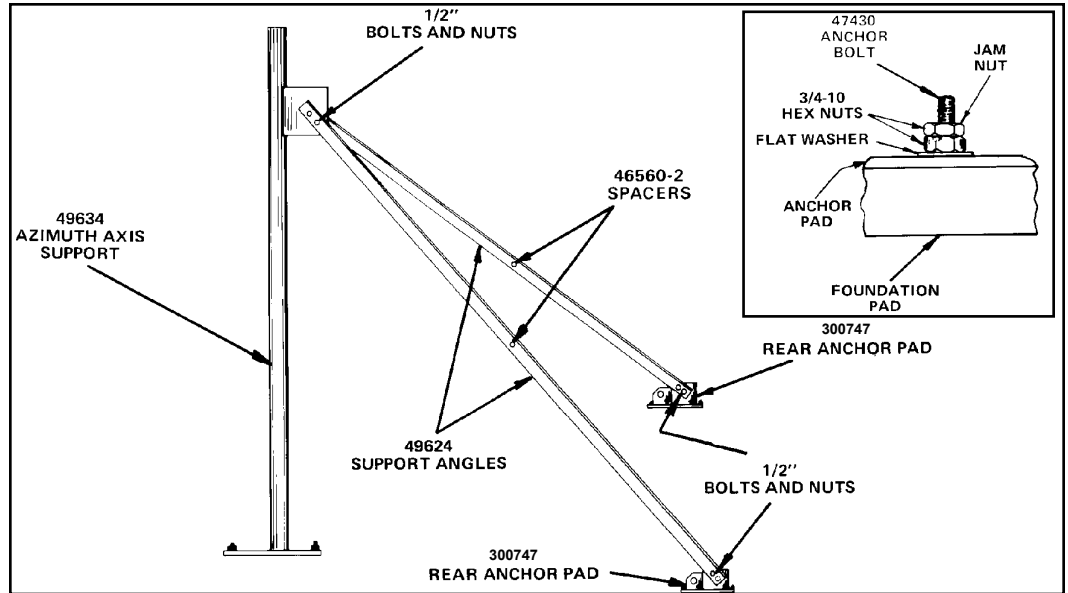


Figure 4

Step 2

Loosely connect support angles (P/N 49624) with spacers (P/N 46560-2) to azimuth axis support and rear anchor pads as shown in figure 5.

- Use A-325 1/2 x 1-1/2 in. bolts and nuts for connections. (see page 12)
- Support angles should be installed edge down with flat of the angle facing upward

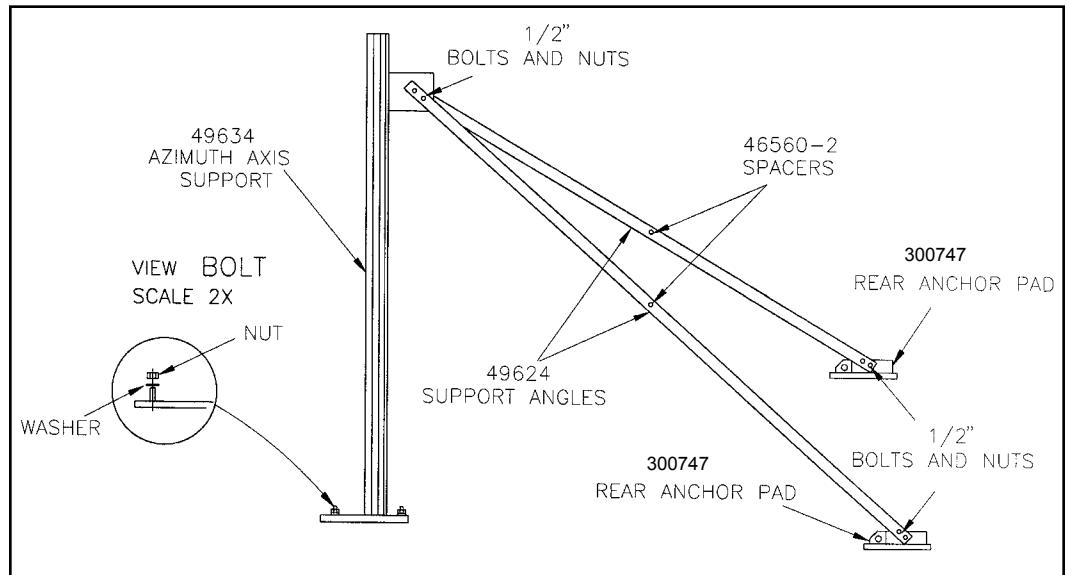


Figure 5

Step 3

Lay out support and elevation pivot assembly (P/N 49635) and support angles (P/N 49623) as shown in Figure 6.



Figure 6

Step 4

Loosely bolt support and elevation pivot assembly (P/N 49635) and support angles (P/N 49623) to connection plates as shown in Figure 7.

- Use A-325 $\frac{1}{2}$ x 1- $\frac{1}{2}$ in. bolts and nuts. (see page 12)
- Angles should be attached with flat of angle facing downward



Figure 7

Step 5

Loosely attach support angles (P/N 49622) to the upper azimuth axis joint (P/N 300748) and the connection plates (part of P/N 49635) as shown in Figure 8.

- Use A-325 ½ x 1-½ in. bolts, flatwashers and nuts. (see page 12)
- Angles should be attached with flat of angle facing upward
- Loosely attach support angles to azimuth axis joint (P/N 49629)

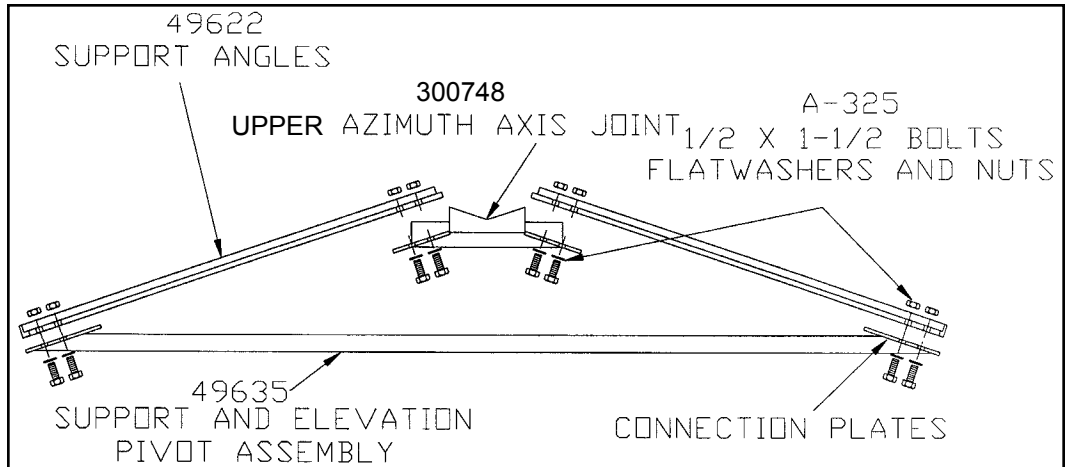


Figure 8

Step 6

Apply a liberal amount of grease (P/N 49208) to azimuth axis support (P/N 49634) and corresponding underside of azimuth axis joint as shown in Figure 9.



Figure 9

- Step 7** Tightly knot 40 ft. rope to azimuth axis joint (P/N 300748) for hoisting to azimuth axis support (P/N 49634).



Figure 10

- Step 8** Station one installer on a ladder to hoist support assembly as at least one other installer walks the assembly into the upright position as shown in Figure 10.

- Step 9** Loosely fasten lower azimuth axis joint (P/N 300746) and upper azimuth axis joint (P/N 300748) to azimuth axis support (P/N 49634) as demonstrated in Figure 11.

- Use 9956-1101 U-bolts, ½ in lockwasher and ½-13 hex nuts.



Figure 11

Step 10

Use a carpenter's level to level support assembly as indicated in Figure 12. Loosen U-bolts to move support assembly up or down as needed to achieve level surface.



Figure 12

Step 11

Tighten anchor bolts on rear pads and azimuth axis support base plate down using A-325 procedure. See A-325 procedure for technique. (see page 12)

Step 12

Loosely attach elevation strut (P/N 49766) to azimuth axis joint (P/N 300746) as shown in Figures 13 and 14.

- Use $\frac{3}{4}$ x 3- $\frac{1}{2}$ in. bolt, lockwasher and nut



Figure 13

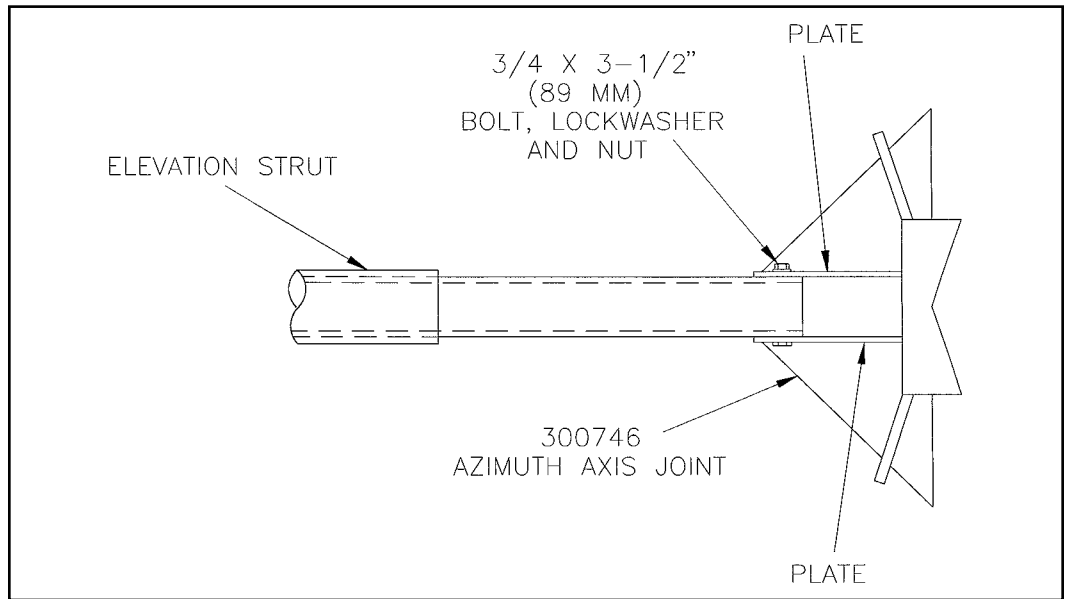


Figure 14

Step 13

Determine required length of elevation strut to nearest degree increment of desired elevation setting as specified in the Elevation and Azimuth Adjustments Section. Adjust coarse setting by extending secondary and, if necessary, tertiary sections to length. Install eight ½ in. set screws and securely tighten as pictured in Figure 15.

CAUTION: Do not extend secondary or tertiary struts into red warning areas.



Figure 15

Step 14

Loosely attach azimuth strut end bracket (P/N 49767) to universal block (P/N 49705) as shown in Figure 16.

- Use $\frac{3}{4}$ x 1- $\frac{1}{4}$ in. bolts, flatwashers and lockwashers

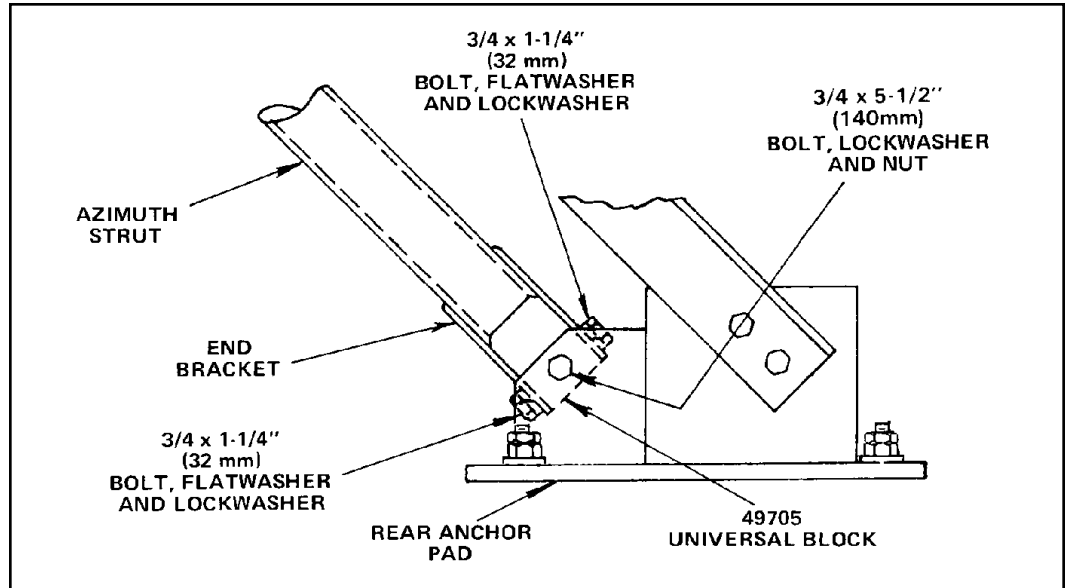


Figure 16

Step 15

Loosely attach block to appropriate rear pad as based upon calculations in Appendix F to determine the mounting configuration of the azimuth strut shown in Figures 16 and 17.

- Use $\frac{3}{4}$ x 5- $\frac{1}{2}$ in. bolts, lockwashers and nuts

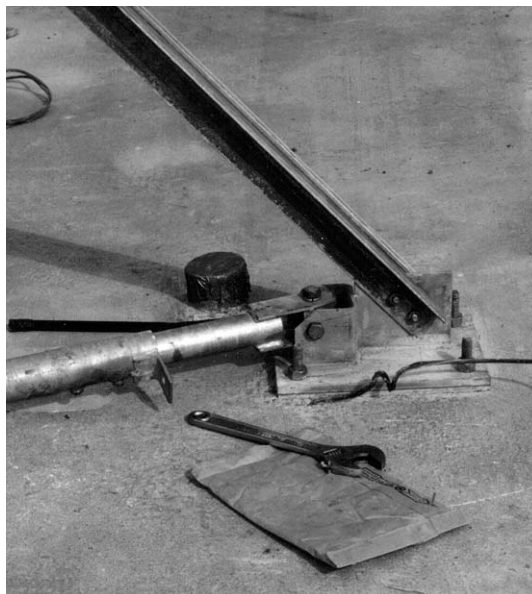


Figure 17

Step 16

Connect U-bracket (P/N 49704) to appropriate connection plate.

- Use A-325 $\frac{1}{2}$ x 1- $\frac{1}{2}$ in. bolts, flatwashers and nuts. (see page 12)



Figure 18

Step 17

Determine required length of azimuth strut to nearest degree increment of desired azimuth setting as specified in the Elevation and Azimuth Adjustments Section. Adjust azimuth setting by withdrawing secondary strut to achieve necessary length. Install four $\frac{1}{2}$ in. set screws and securely tighten as demonstrated in Figure 19.



Figure 19

Step 18

Connect one end of azimuth strut (P/N 49767) to connection plate with U-bracket (P/N 49704) as indicated in Figure 18.

- Use $\frac{3}{4}$ x 4- $\frac{1}{2}$ in. bolts, lockwashers and nuts

Securely tighten all A-325 ground mount hardware except the fine adjustment hardware per A-325 tensioning procedure (see page 12).

Step 19

The tripod ground mount assembly is now completed with the necessary operational essentials. All ground mount options have separate instructional bulletins located in the parts kit that contain the option. The next step in the installation process is the reflector assembly. Proceed to the appropriate section for the type of reflector you are installing.

ES45T-R Reflector Assembly

ES45T-R Reflector

The ES45T-R-1 reflector is composed of six precision-formed panels designed for accuracy and strength and ensure reliable surface contour which provides exceptional operating characteristics in C- or Ku-frequency band.

Step 1

Reflector should be assembled on a clear, flat area in front of the foundation pad. Clear debris from area and place plastic sheeting from packing crate as shown in Figure 22.

Step 2

Arrange the six diameter setting bands (P/N 49426) and temporary supports as shown in Figure 20.

Note: Proper orientation of reflector (top, bottom) will ease reflector assembly

- Tighten 1/4-20 hardware at connection of bands to a snug fit
- Reflector should be assembled in front of foundation pad with bottom of reflector 3 ft. from pad
- Supports should be 6-8 in. high
- Tie three string levels to opposing sets of blocks across diameter of circle
- Adjust supports with shims until strings are level and lightly touch at center of circle
- Once supports are level, remove strings
- Move supports 12 in. radially away from circle, carefully maintaining orientation and height for later reuse

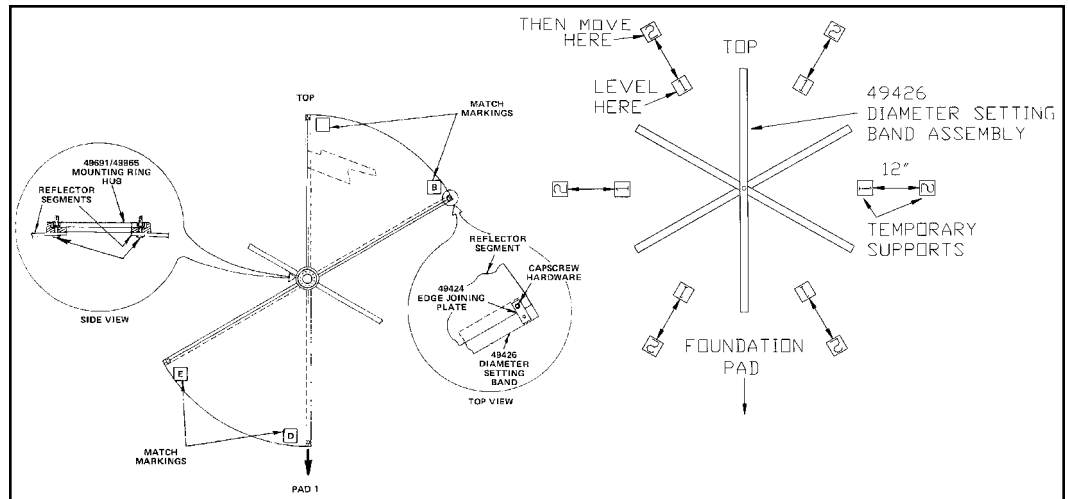


Figure 20

ES45T-R Reflector Assembly

Note: All six reflector segments are identified individually by a two letter designation (A-B, D-E, etc). Locate the markings on the reflector segments in order to assemble the reflector in the proper sequence. See Figure 21.

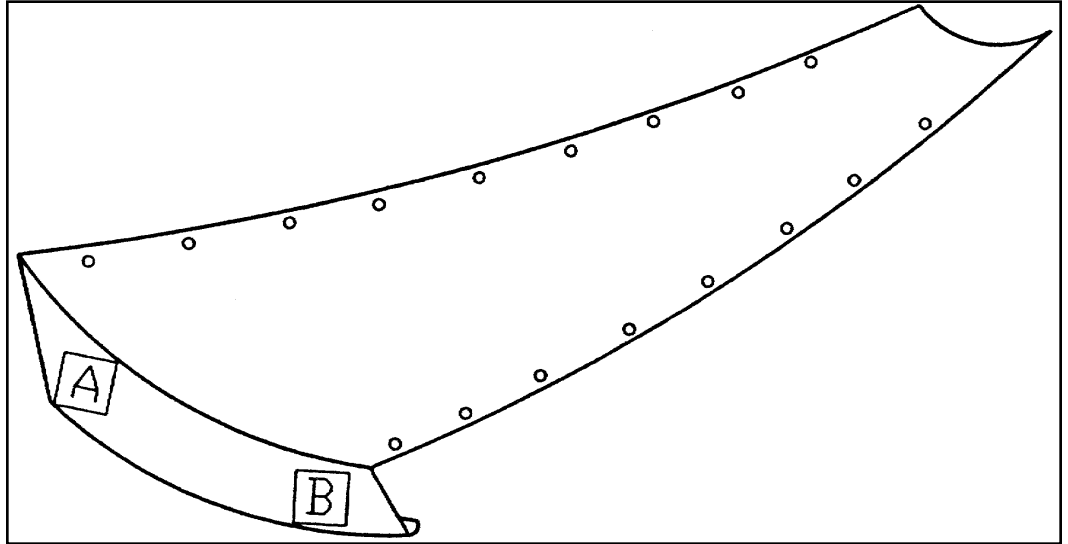


Figure 21

Step 3

Place reflector segment **A-B** between two setting bands with concave side down as shown in Figure 22. Place reflector segment **D-E** opposite panel **A-B**.



Figure 22

ES45T-R Reflector Assembly

Step 4 Raise segments and hold while loosely attaching mounting ring hub (P/N 49965) to convex side of center opening.

- Use ¼-20 capscrews, lockwashers and nuts
- Insert capscrews from concave side of reflector segments

Step 5 Loosely attach reflector segments **A-B** and **D-E** to diameter setting bands (P/N 49426) with edge joining plates (P/N 49424) and capscrew hardware as shown in Figure 23.

- Use ¼-20 capscrews, lockwashers and nuts
- Insert capscrews from concave side of reflector segments

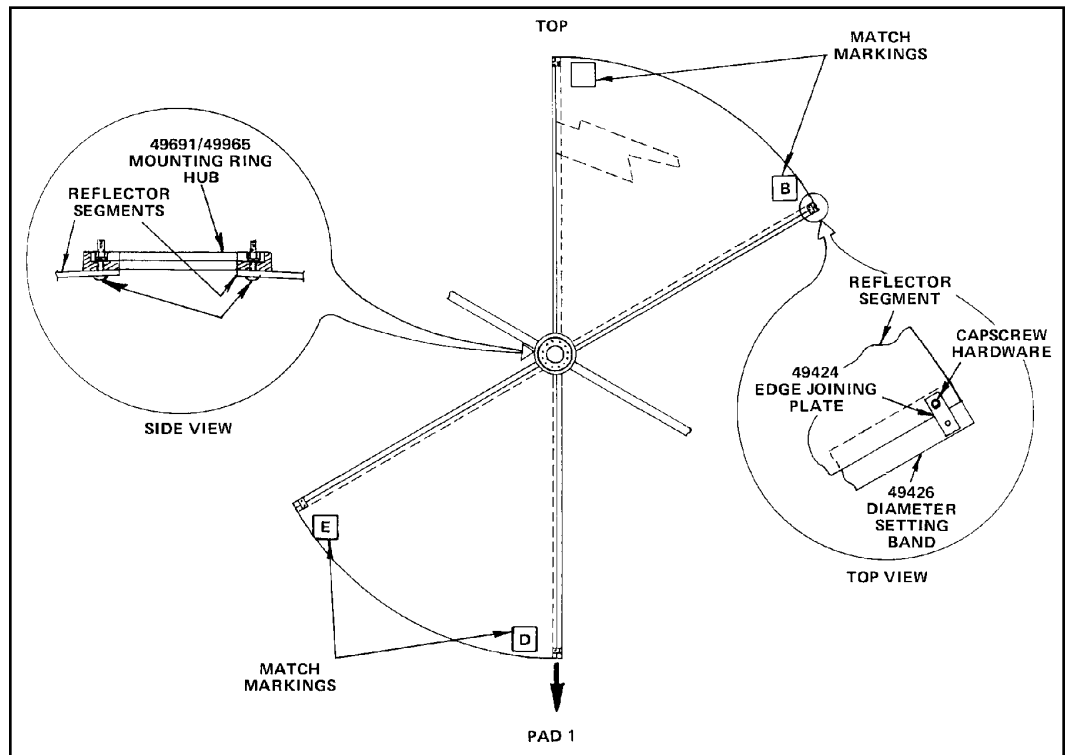


Figure 23

ES45T-R Reflector Assembly

Step 6 Loosely attach segment **A-F** to mounting ring hub, diameter setting bands and segment **A-B** using joining plates (P/N 49425) along reflector panel seam as pictured in Figure 24.

- Place spacers (P/N 200215) between first and third segments
- Insert ¼-20 capscrews from concave side of reflector segments



Figure 24

Step 7 Loosely attach joining plate (P/N 49693) along **A-A** seam inside reflector rim as shown in Figure 25.

- Insert ¼-20 capscrews from outside reflector rim

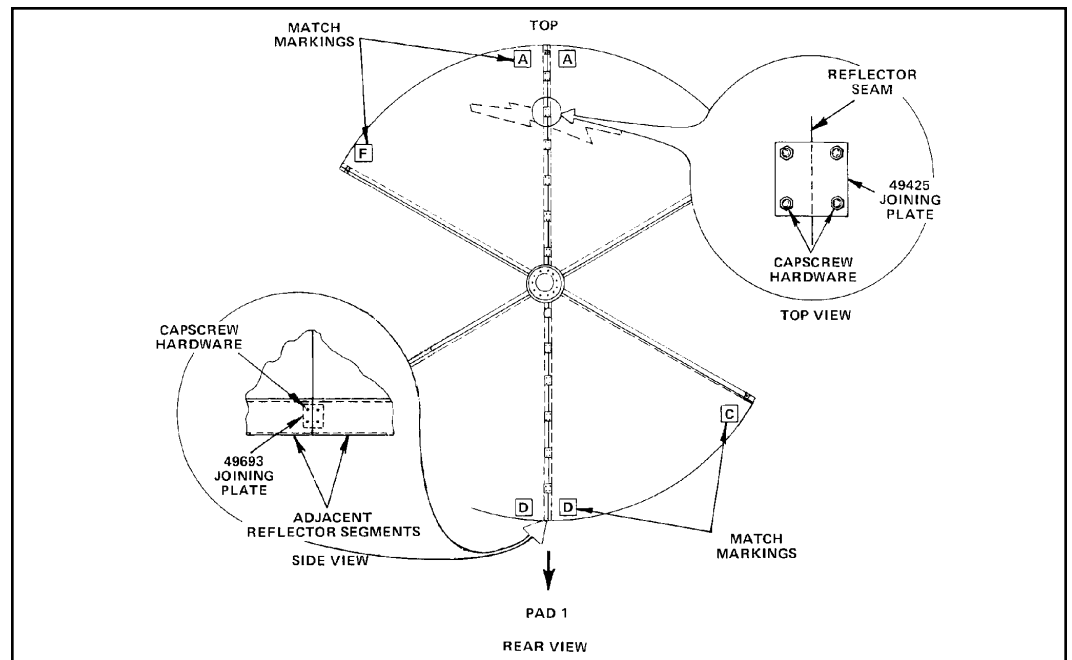


Figure 25

ES45T-R Reflector Assembly

- Step 8** Loosely attach segment **E-F** to mounting ring hub, diameter setting bands and segments **A-F** and **D-E** with joining plates (P/N 49425) along reflector panel seams **E-E** and **F-F**. Loosely attach joining plates (P/N 49693) on rim seams **E-E** and **F-F** as illustrated in Figure 26.



Figure 26

- Step 9** Station an installer inside reflector to finger-tighten seam hardware and attach final panels as pictured in Figure 27.



Figure 27

ES45T-R Reflector Assembly

Step 10 Loosely attach reflector segment **B-C** to mounting ring hub and diameter setting bands. Use joining plates (P/N 49425) along **B-B** panel seam and joining plate (P/N 49693) on **B-B** rim seam.

Step 11 Before last panel, lift reflector and return temporary supports to initial measuring position. Have installer inside reflector ensure setting bands are uniformly taut at this point. If not, adjust level by adding shims until no segment of the reflector can bounce and setting bands are uniformly taut, as shown in Figure 28.



Figure 28A

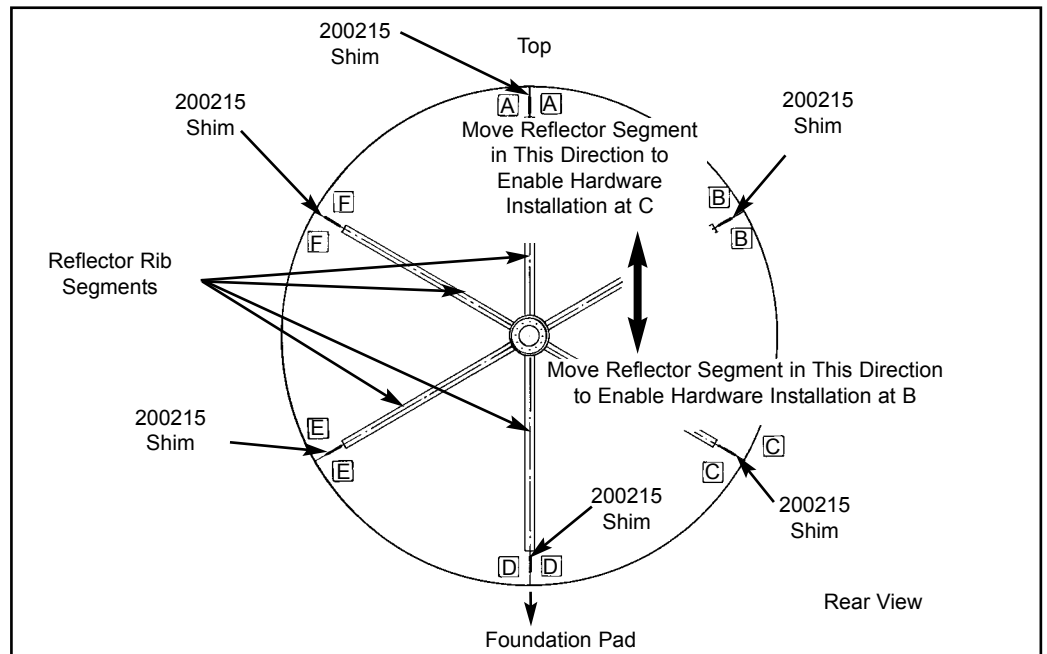


Figure 28B

ES45T-R Reflector Assembly

- Step 12** Install last reflector panel (C-D) by loosely attaching to diameter setting bands and mounting ring hub. Loosely attach panel seam hardware as installer inside moves reflector segment to enable segment union.
- Step 13** Loosely attach retaining bar (P/N 49997) to mounting ring hub (P/N 202429). Loosely attach center plate (P/N 49964-2) to concave side of reflector.
- Insert capscrew hardware from plate (concave side of reflector) to retaining bar
- Step 14** Insert shim (P/N 200215) between each reflector segment around perimeter of reflector assembly. Refer to Figure 28B. Tighten setting band and joining plate hardware (P/N 49693).

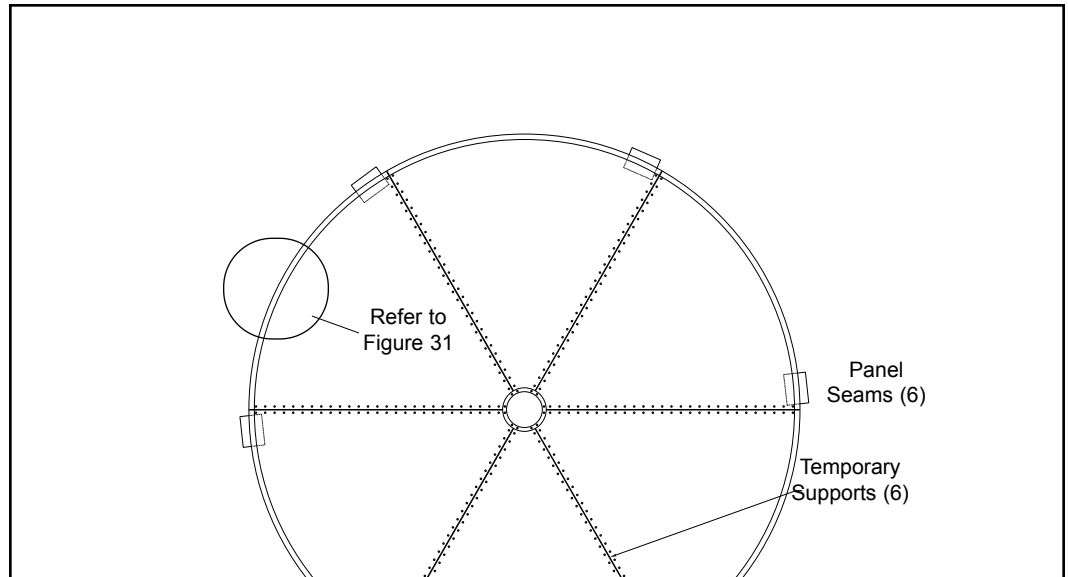


Figure 29

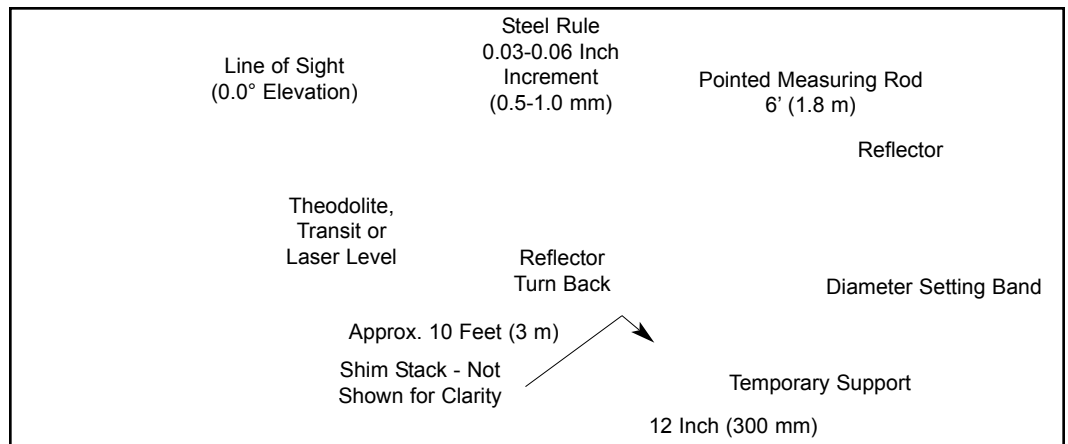


Figure 30

ES45T-R Reflector Assembly

Reflector Leveling Procedure

Step 1

Position (6) temporary supports near panel seams exactly as shown in Figure 29.

Note: Temporary supports should be large enough to adequately support the reflector and strong enough to easily support reflector weight without compressing.

Step 2

Position theodolite, transit or laser level about 10 feet [3m] from outside perimeter of reflector (see Figure 30).

Step 3

Level theodolite/transit/laser level. If using theodolite, position view scope at 0.0 degrees elevation, lock down elevation adjustment.

Step 4

Site through theodolite/transit/laser level to determine where on measuring rod to place steel rule onto rod to allow visibility of steel rule through theodolite/transit at all (6) six measurement locations around reflector. Securely fasten both ends of steel rule to measuring rod with adhesive tape (see Figure 30).

Step 5

Temporary supports should be positioned as shown in Figure 31, close to but not interfering with diameter setting bands.

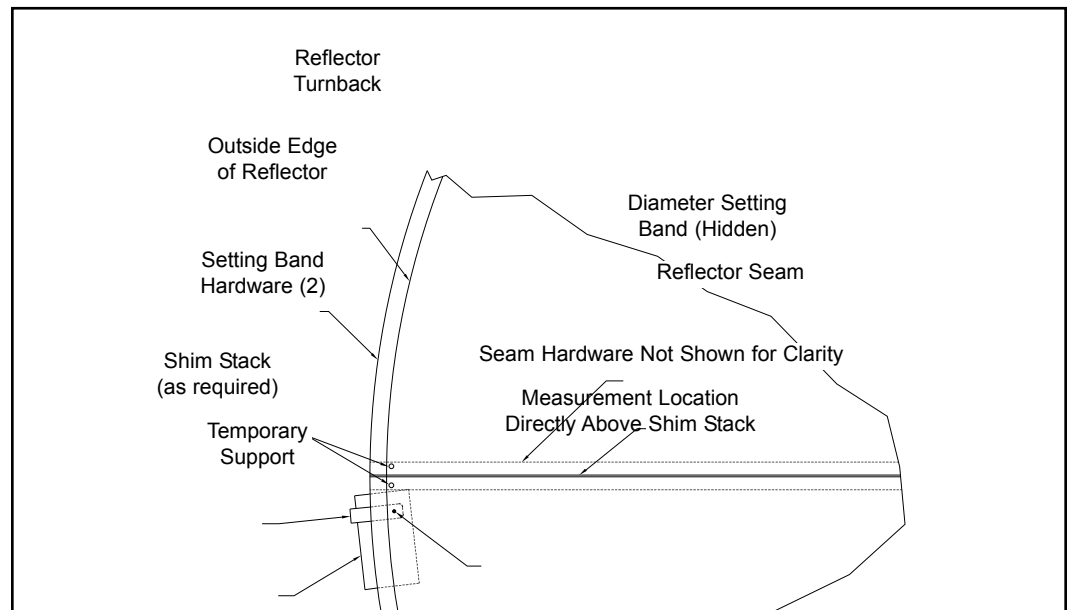


Figure 31

Step 6

Referring to Figure 31, mark the measuring location at each of the six temporary support locations with a small dot (use felt tip marker) to be used as reference point in subsequent measurements.

Step 7

Position measuring rod point down over temporary supports and on the flat portion of the aperture face as shown in Figures 30 and 31, using theodolite/transit/laser level carefully measure and record relative height of each of the (6) temporary support locations. **Note:** Measuring rod must be held in a vertical position during all measurements.

Step 8

From the recorded data determine the relative height of each of the locations as compared to the highest measured location. The differences between the highest location and a lower location will be the amount of shim material required to place between the reflector and the temporary support.

ES45T-R Reflector Assembly

- Step 9** Shim each location as required to level the reflector (see Figure 31).
- Step 10** Continue to measure around antenna again, recording the height of each location measured. As before, shim the low location points to be at the same elevation as the highest measured location.
- Step 11** Continue to measure, record, compare and shim any low temporary support location points until all (6) temporary location points are within 0.030 inches [0.75 mm] elevation from each other.
- Step 12** Recheck the shim stacks required for leveling the reflector to ensure they are properly positioned and are adequately supporting the reflector. **Note:** As work continues on the reflector it is essential that the shim stacks remain in position through out this process. Also ensure that diameter setting bands are taut and evenly tensioned. If not, check to ensure proper leveling of temporary supports.
- Step 13** With the reflector level, tighten joining plate (P/N 49425) hardware starting at the outer perimeter of match marked position A-A and continue this procedure around reflector in concentric circles while progressing inward toward reflector vertex. **Note:** Near vertex area, it may become necessary to push down on mounting ring hub to narrow segment gap before tightening hardware.

Feed Strut Assembly

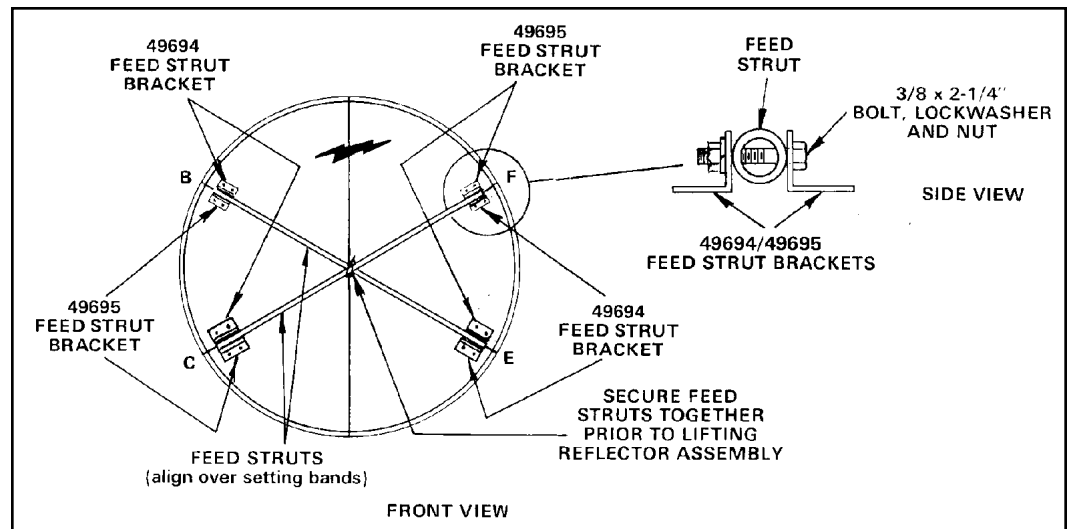


Figure 32

- Step 1** Installer underneath reflector should attach four of each feed strut brackets (P/N 49694/49695) as shown in Figure 32.
- Use A-325 1/2 x 1-1/4 in. bolts, flatwashers and nuts (see page 12).
 - Insert bolts from concave sides of reflector
- Step 2** Pass feed struts (P/N 49703) to installer underneath for attachment to feed strut brackets (P/N 49694/49695).
- Use 3/8 x 2-1/4 in. bolts, lockwashers and nuts
 - Secure feed struts together after attachment to feed strut brackets as shown in Figure 32
- You have now completed the assembly of the ES45T-R-1 or the ES45TDR reflector. The next step in the installation is the assembly of the back structure, which follows in the next section.

ES45T-R Reflector Assembly

ES45T-R-1 Back Structure

The back structure assembly attaches to the rear of the reflector. The back structure provides stability for the reflector and maintains the parabolic accuracy of the dish. An example of the assembled back structure is presented in Figure 33.



Figure 33

Before assembling the back structure, verify that the appropriate parts are present. The following steps provide the procedure for the back structure assembly.

CAUTION: Reflector must remain on level supports positioned under center edge of each reflector segment with diameter setting bands in place during assembly of back structure. Once back structure is attached and all bolts tightened, reflector will be held in its assembled shape. If back structure is added with reflector in distorted shape, back structure will hold reflector in that shape. If standing or walking on reflector becomes necessary, concentrate major portion of body weight towards center of reflector panel.

ES45T-R Reflector Assembly

Step 1

Refer to back structure Figure 34 for positioning and orientation details.

- Apply stick wax (P/N 200852) to A-325 bolt threads before installation to reduce friction. (see page 12)

Note: Do not attempt to tighten A-325 hardware prior to tensioning sequence in assembly procedure

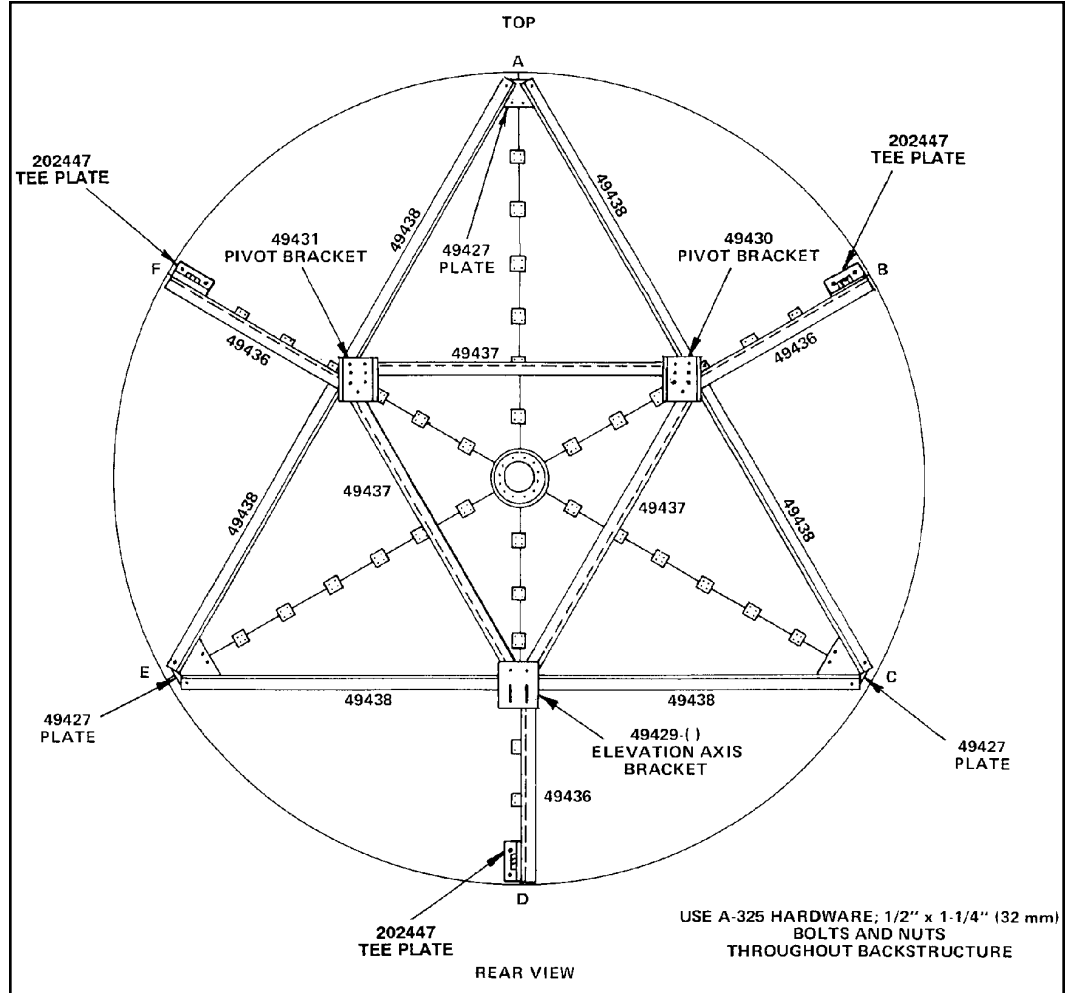


Figure 34

ES45T-R Reflector Assembly

Step 2 Loosely attach tee plates (P/N 202447) to points **B**, **F** and **D** on convex side of reflector as shown in Figure 35.

- Use A-325 $\frac{1}{2}$ x 1- $\frac{1}{4}$ in. bolts, flatwashers and nuts. (see page 12).
- Insert bolts from concave side of reflector

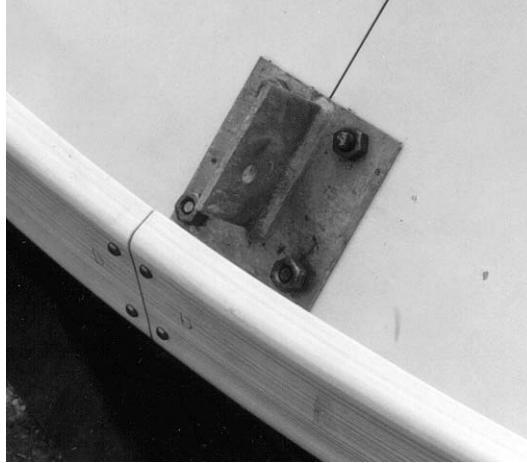


Figure 35

Step 3 Loosely attach plates (P/N 49427) to points **A**, **C** and **E** on convex side of reflector. Loosely attach two support angles (P/N 49438) to each of six plates as shown in Figure 36.

- Use A-325 $\frac{1}{2}$ x 1- $\frac{1}{4}$ in. bolts, flatwashers and nuts. (see page 12)
- Install bolts from concave side of reflector
- Angles should be installed with flat side towards back side of reflector

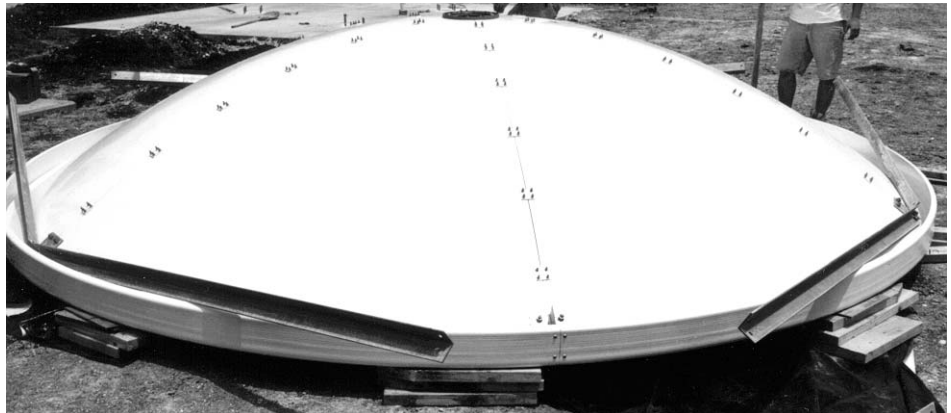


Figure 36

ES45T-R Reflector Assembly

Step 4 Loosely attach support angles (P/N 49436) to three tee plates (P/N 202447) as shown in Figure 37.

- Use A-325 $\frac{1}{2}$ x $1\text{-}\frac{1}{4}$ in. bolts, flatwashers and nuts. (see page 12)
- Install bolts from concave side of reflector
- Angles should be installed with edge in and flat side away from reflector as shown.

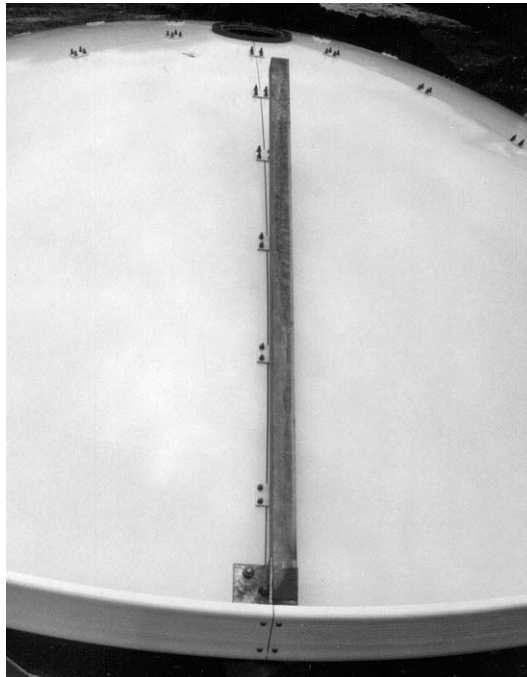


Figure 37

Step 5 Loosely attach support angles (P/N 49438) from plates E and A to angle (P/N 49436) from tee plate F with pivot bracket (P/N 300758) as illustrated in Figure 38.



Figure 38

ES45T-R Reflector Assembly

Step 6 Loosely attach support angles (P/N 49438) from plates A and C to angle (P/N 49436) from tee plate B with pivot bracket (P/N 300745).

Step 7 Loosely connect support angles (P/N 49438) from plates E and C to angle (P/N 49436) from tee plate D to elevation axis bracket (P/N 300749) as shown in Figure 39.



Figure 39

Step 8 Loosely connect pivot brackets and elevation axis bracket with the three support angles (P/N 49437) as pictured in Figure 40.

- Angles should be installed edge down with flat of angle away from reflector.

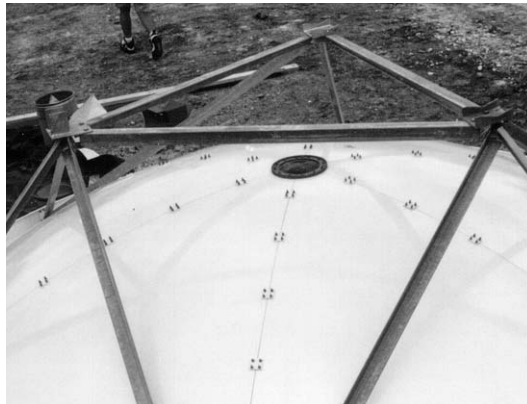


Figure 40

Step 9 Check diameter setting bands to ensure that they are uniformly taut. If not, check leveling of temporary supports and make necessary adjustments by adding or subtracting shims.

Step 10 Begin A-325 hardware tensioning procedure (see page 12) . Work from connections closest to backside of reflector to those connections furthest away in this order: Start with plates (P/N 49427) and tee plates (P/N 202447). Next tighten support angle connections. Tighten the pivot brackets and elevation axis bracket last.

You have now completed the assembly of the back structure and its attachment to the reflector. Proceed to the next section for instructions on mounting the reflector to the tripod ground mount assembly with a crane, or the appropriate section for instructions on mounting the reflector with the hoist kit.

ES45T-R Reflector Assembly

Reflector-to-Mount Assembly (With Crane)

This reflector can be installed on the mount manually or by using a crane. However, Andrew recommends that this procedure be performed using a crane.

The following steps provide the procedure for installing the reflector to the mount using a crane.

Step 1

Ensure all connections on reflector and back structure are tight.

Step 2

Wrap crane straps around support angle between pivot brackets as illustrated by Figure 41.

- Hoist reflector slightly off ground to remove diameter setting bands
- Reattach hardware through edge joining plates



Figure 41

ES45T-R Reflector Assembly

Step 3

Crane should place reflector so that pivot brackets align with support and elevation pivot assembly as shown in Figure 42.



Figure 42

Step 4

Attach pivot brackets to support and elevation pivot assembly with U-bolts (P/N 9956-65), ½ in. lockwashers and ½-13 hex nuts as shown in Figures 43 and 44.



Figure 43

ES45T-R Reflector Assembly

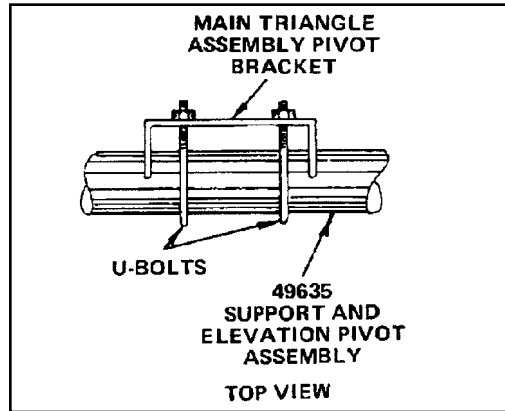


Figure 44

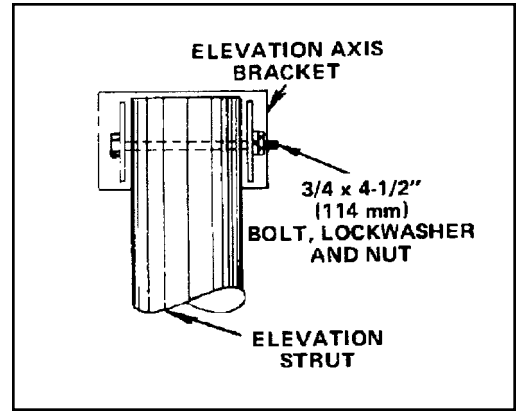


Figure 45

Step 5

Manually raise reflector to attach remaining end of elevation strut to elevation axis bracket of main triangle assembly as shown in Figures 45 and 46.

- Use $\frac{3}{4}$ x 4- $\frac{1}{2}$ in. bolt, lockwasher and nut



Figure 46

You have now completed the attachment of the reflector to the tripod ground mount assembly. If assembling a ES45T-R antenna, proceed to the Elevation and Azimuth Adjustments section for instructions on aiming your antenna at its desired satellite.

ES45T-R Reflector Assembly

Reflector-to-Mount Assembly (With Hoist Kit)

The optional hoist kit (P/N 49080) must be assembled prior to reflector/ backstructure assembly hoisting. Hoist assembly should not be used for antenna elevation angle adjustment. The following steps provide the procedure for installing the reflector with the hoist kit.

Step 1

Install support tab assembly (P/N 49067) into top of azimuth axis support (P/N 49634) as shown in Figure 47.

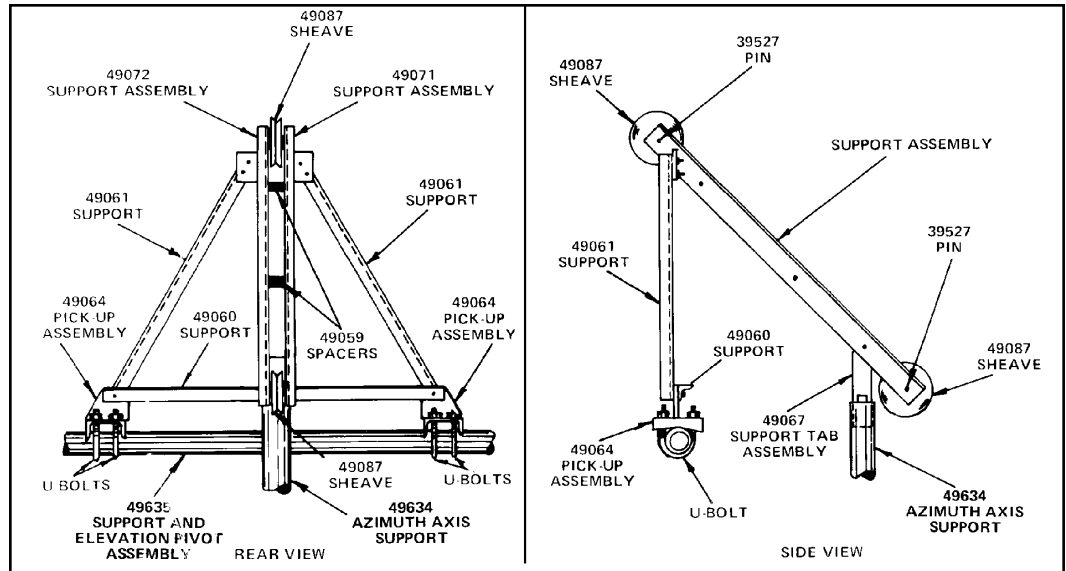


Figure 47

Step 2

Loosely attach corresponding support assemblies (P/N 49071 and 49072) using spacers (P/N 49059) and appropriate hardware (P/N 45980-6).

- Angles should be installed edge down with flat of angles facing upward.

Step 3

Install sheaves (P/N 49087) at each end between support assemblies using pins (P/N 39527) with cotter pins (P/N 9958-6). Securely tighten support assembly hardware.

Step 4

Attach entire support assembly to previously installed support tab assembly (P/N 49067) using appropriate hardware (P/N 45980-6).

Step 5

Loosely attach pick-up assemblies (P/N 49064) to support and elevation pivot assembly (P/N 49635) as shown.

- Use supplied U-bolts with 1/2 inch (13 mm) lockwashers and nuts.
- Pick-up assemblies are mounted with slanted tabs facing outward.

Step 6

Loosely attach supports (P/N 49061) to corresponding tabs on support assemblies (P/N 49071 and 49072) using appropriate hardware (P/N 45980-1).

- Angles are installed edge down with flat of angles facing upward

ES45T-R Reflector Assembly

Step 7

Loosely attach support (P/N 49060) and remaining ends of supports (P/N 49061) to corresponding pick-up assemblies (P/N 49064) using appropriate hardware (P/N 45980-1). Securely tighten all mounting hardware.

- Ensure entire hoist assembly is centered on support and elevation pivot assembly (P/N 49635)

Step 8

Securely attach winch assembly (P/N 39532) to lower portion of azimuth axis support (P/N 49634) using supplied U-bolts, lockwashers and nuts as shown in Figure 48.

- Keep winch cable aligned with sheaves

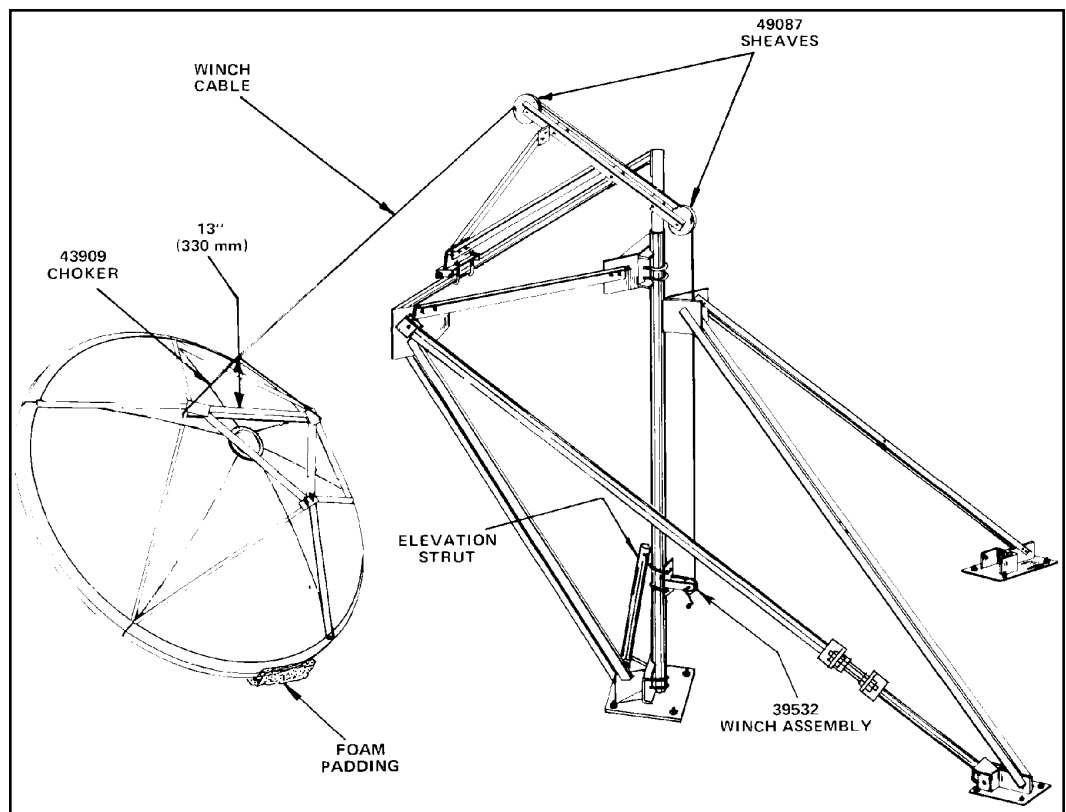


Figure 48

Step 9

Begin releasing winch cable. Route cable through both sheaves allowing sufficient cable length to reach top of main triangle assembly on reflector backstructure.

Step 10

Route P/N 43909 or customer-supplied 18-foot (5500 mm) choker assembly behind both pivot brackets of main triangle assembly as shown. Attach end of choker to winch or crane cable hook.

- Distance between choker/winch connection and top of main triangle assembly should be approximately 13 inches (330 mm).

ES45T-R Reflector Assembly

Step 11 Remove small portion of foam padding from reflector packing crate and install under bottom portion of reflector assembly to prevent reflector damage during hoisting procedure. Position man at bottom of reflector/backstructure to guide assembly during hoisting procedure.

Step 12 Hoist reflector/backstructure assembly to vertical position until upper joints of main triangle assembly contact pipe and straddle two locator bars on support and elevation assembly (P/N 49635) as shown in Figure 49.

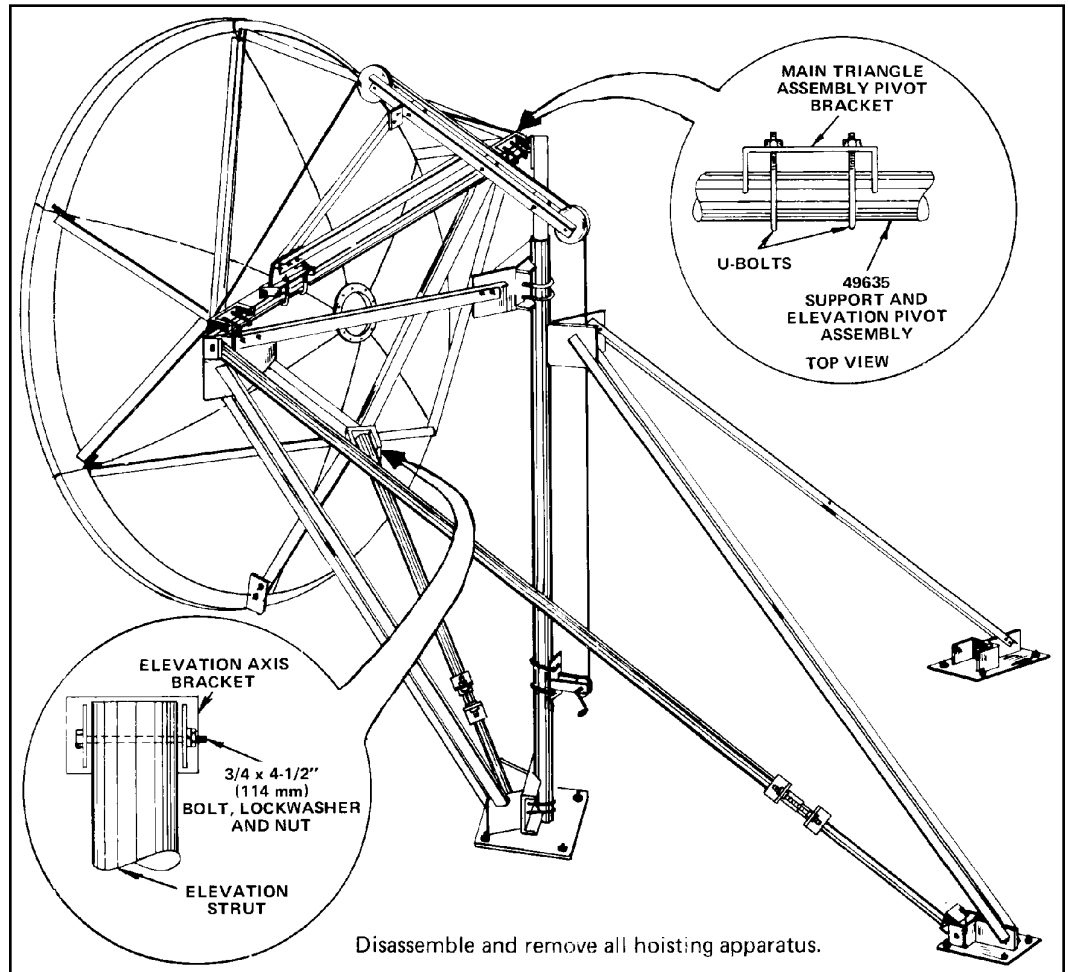


Figure 49

Step 13 Install two U-bolts at each pivot bracket of main triangle assembly.

- Use 1/2 inch (13 mm) lockwashers and nuts.
- Securely tighten U-bolts allowing for some reflector movement

ES45T-R Reflector Assembly

Step 14 Raise lower portion of reflector/backstructure assembly and attach remaining end of elevation strut to elevation axis bracket of main triangle assembly.

- Use 3/4 x 4-1/2 in (114 mm) bolt, lockwasher and nut
- Mechanical means or fine adjustment assembly may be utilized to achieve elevation angles greater than 30°.

Step 15 Set fine elevation and azimuth strut positions based on the procedure performed in the Elevation and Azimuth Adjustments section.

- If fine alignment is not performed at this time, continue the assembly procedure at Step 16.

Step 16 Securely tighten U-bolts and elevation strut mounting hardware.

Step 17 Remove both fine adjustment assemblies and store in a weather protected location for future use. Continue with feed system and corresponding LNA installation.

You have now completed the attachment of the reflector to the tripod ground mount assembly. If installing an ES45T-R antenna, advance to the Elevation and Azimuth Adjustments section for instructions on pointing your antenna to its satellite.

ES45T-R Reflector Assembly

Elevation and Azimuth Adjustments

Step 1

Proper antenna pointing requires specific coarse and fine elevation and azimuth strut length adjustments which can be determined using the graphs provided in Appendix F. Adjustable azimuth and elevation struts are initially set in coarse setting as near as possible to pre-determined lengths. Fine elevation and azimuth settings are accomplished with threaded rod on elevation and azimuth struts.

CAUTION

Never loosen strut set screws and fine adjustment assembly U-bolts simultaneously. Doing so may result in severe bodily harm and equipment damage.

Step 2

Coarse Elevation Adjustment. Station at least two installers at reflector rim to provide temporary reflector support while third installer loosens two U-bolts on each end of elevation pivot assembly (P/N 49635) and removes 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut connecting elevation strut to bottom of main triangle assembly. Carefully lower reflector to vertical position.

Step 3

Determine required length of elevation strut to nearest degree increment of desired elevation setting. Adjust coarse elevation setting by withdrawing secondary and, if necessary, tertiary strut sections from primary strut to achieve required strut length. Install eight 1/2 inch (13 mm) set screws in holes provided and securely tighten.

Note: Do not extend secondary or tertiary strut sections into red warning areas.

Step 4

Carefully raise reflector and attach elevation strut to bottom of main triangle assembly using previously removed 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut.

Note: Mechanical means or fine adjustment assembly may be used to achieve elevation angles greater than 30°.

Step 5

Coarse Azimuth Adjustment. Loosen to U-bolts on both upper (P/N 49630) and lower (P/N 49629) azimuth axis joints. Remove 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut connecting azimuth strut to U-bracket (P/N 49704).

Step 6

Determine required length of azimuth strut to nearest degree increment of desired azimuth setting. Adjust coarse azimuth setting by withdrawing secondary strut section from primary strut to achieve desired strut length. Install four 1/2 inch (13 mm) set screws in holes provided and securely tighten.

Note: Do not extend secondary strut section into red warning area.

Step 7

Carefully pivot reflector as required and attach azimuth strut to U-bracket using previously removed 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut.

Note: Apply grease (P/N 49208) around bottom area of lower azimuth axis joint assembly (P/N 49629) before changing azimuth position of antenna.

ES45T-R Reflector Assembly

Step 8

Fine Adjustment. Attach fine adjustment assembly between adjacent elevation strut sections as shown in Figure 50 using appropriate brackets, U-bolts, brass hex nuts, flatwashers and threaded rod. Securely tighten all adjustment assembly hardware.

Note: Adjustment assembly may also be attached in alternate position shown depending on required elevation angle.

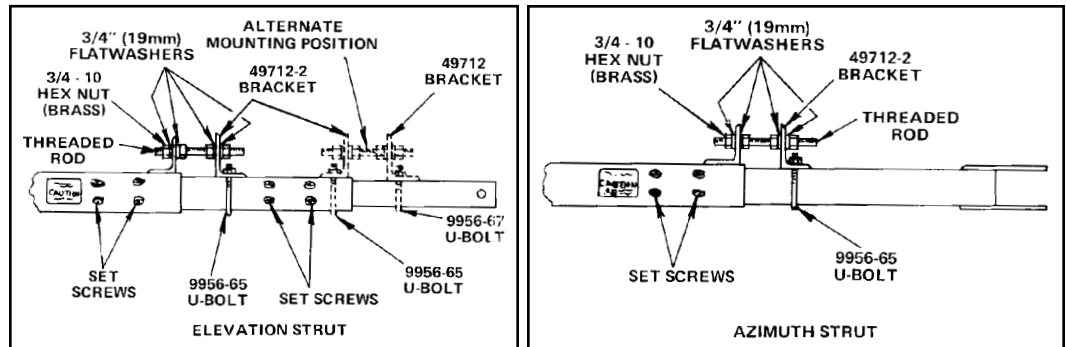


Figure 50

Figure 51

Step 9

Attach fine adjustment assembly between adjacent azimuth strut sections as shown in Figure 51 using appropriate brackets, U-bolts, brass hex nuts, flatwashers and threaded rod. Securely tighten all adjustment assembly hardware.

Note: Fine adjustment assembly on azimuth strut should be positioned away from ground mount angles.

Step 10

Set fine elevation and azimuth strut positions by loosening strut set screws and selected out fine adjustment hex nut. Turn corresponding inner hex nut in appropriate direction until required strut length is achieved. Securely tighten strut set screws and corresponding outer hex nut.

Step 11

During final electrical tuning, adjust elevation and azimuth struts appropriately to lengthen or shorten struts for optimal signal strength.

Step 12

After fine adjustments are complete, ensure strut set screws are securely tightened to **50-60 ft-lbs** and spray with zinc-rich paint. Securely tighten hex nuts and U-bolts on both elevation and azimuth fine adjustment assemblies.

Step 13

Securely tighten eight U-bolts on elevation pivot assembly and upper and lower azimuth axis joints.

Step 14

Remove both fine adjustment assemblies and store in weather protected location for future use.

You have now finished aiming your antenna at the desired satellite. Proceed to the feed support installation section for instructions on assembling and attaching the feed support assembly to the reflector.

Feed Support Assembly

By now, you can see that your installation of the 4.5-Meter Earth Station Antenna is almost complete. The feed system is the last phase of the base installation described in this manual.

Note: All antenna options (such as feeds, shields, anti-icing, etc.) possess installation instructions within the individual kits contained in the shipment.

Step 1 Attach feed struts to 222930 feed support as shown in Figures 52 and 53.

- Use 3/8 x 2 in. bolt, lockwasher and nut

Step 2 Install supplied feed system according to installation instructions provided with applicable feed system.



Figure 52

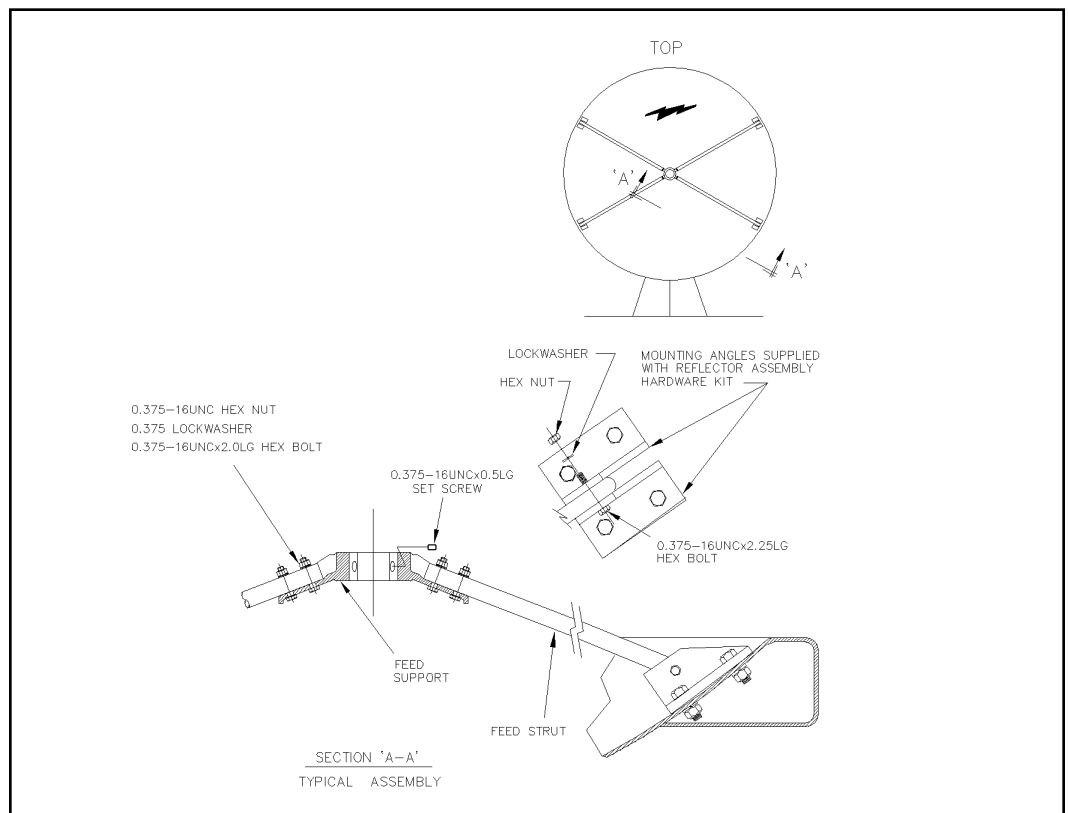


Figure 53

ES45T-T Reflector Assembly

ES45T-T-1 Reflector

The ES45T-T-1 reflector is composed of six precision-formed panels designed for accurate strength, and ensures a reliable surface contour that provides exceptional operating characteristics in C-, X- or Ku-frequency bands.

Step 1

Reflector should be assembled on a clear, flat area in front of the foundation pad. Clear debris from area and place plastic sheeting from packing crate as shown in Figure 56.

Step 2

Arrange diameter setting band assembly (P/N 49612) and temporary supports as shown in Figure 54.

- Tighten $\frac{1}{4}$ -20 hardware at center connection until snug
- Reflector should be assembled in front of foundation pad with bottom of reflector 3 ft. from pad
- Temporary supports should be 6-8 in. high
- Tie three string levels to opposing blocks across diameter of circle
- Adjust supports with shims until strings are level and lightly touch at center of circle
- Once supports are level, remove strings
- Move supports 12 in. radially away from circle, carefully maintaining orientation and height for later reuse

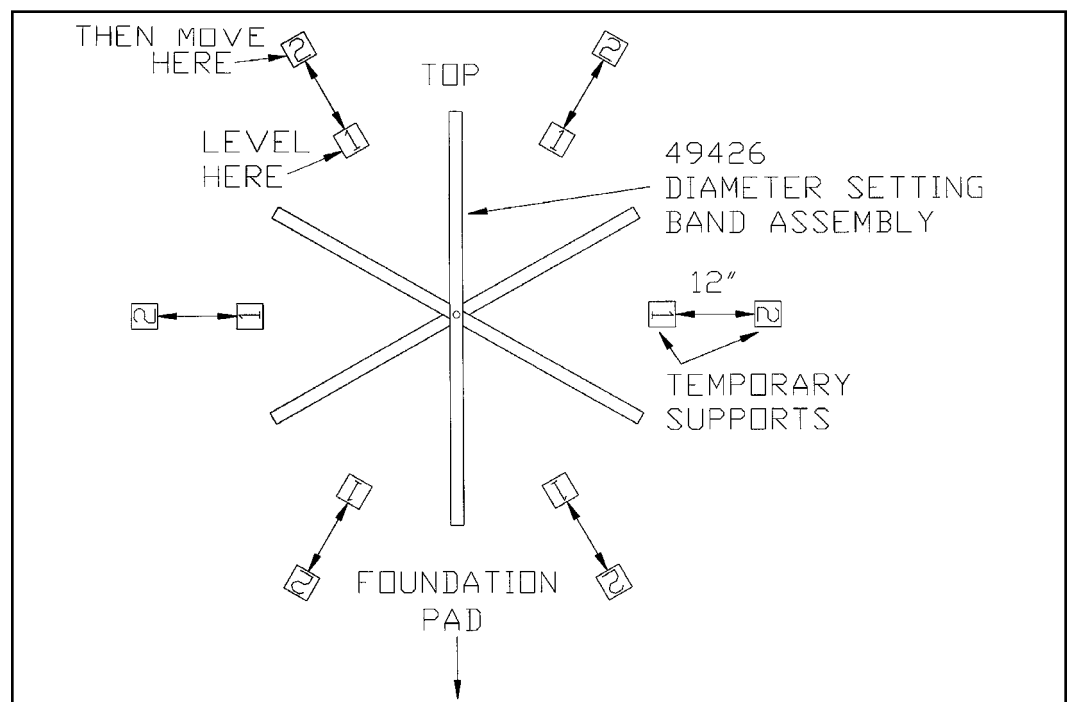


Figure 54

ES45T-T Reflector Assembly

Note: All six reflector segments are identified individually by a two letter designation (**A-B**, **D-E**, etc). Locate the markings on the reflector segments in order to assemble the reflector in the proper sequence. See Figure 55.

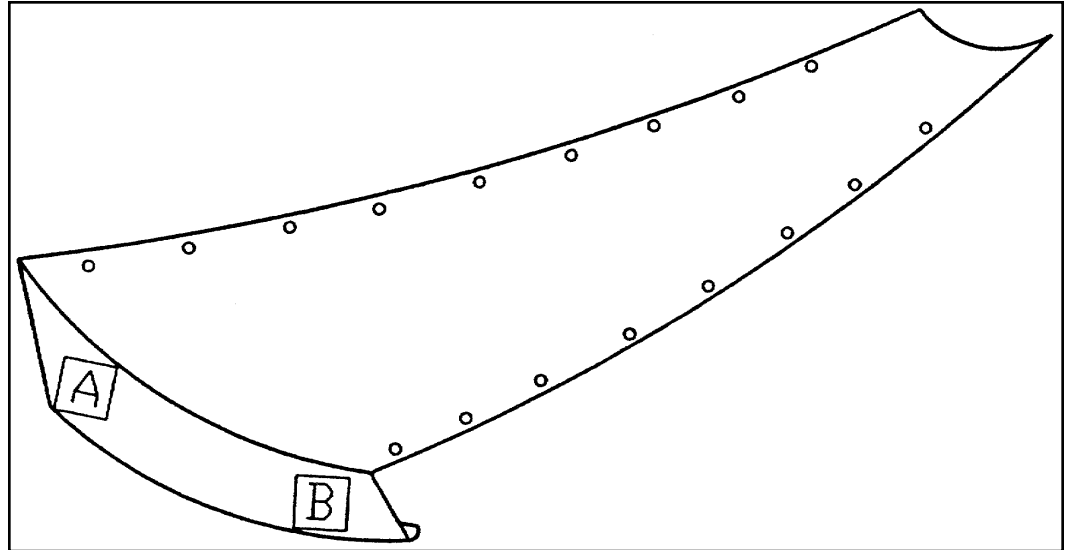


Figure 55

Step 3

Place reflector segment A-B between two setting bands with concave side down as shown in Figure 56. Place reflector segment **D-E** opposite panel **A-B**.



Figure 56

Step 4

Raise segments and hold while loosely attaching mounting ring hub (P/N 202429) to convex side of center opening.

- Use 1/4-20 capscrews, lockwashers and nuts
- Insert capscrews from concave side of reflector segments

ES45T-T Reflector Assembly

- Step 5** Loosely attach reflector segments **A-B** and **D-E** to diameter setting bands (P/N 49612) with edge joining plates (P/N 49424) and capscrew hardware as indicated in Figure 57.

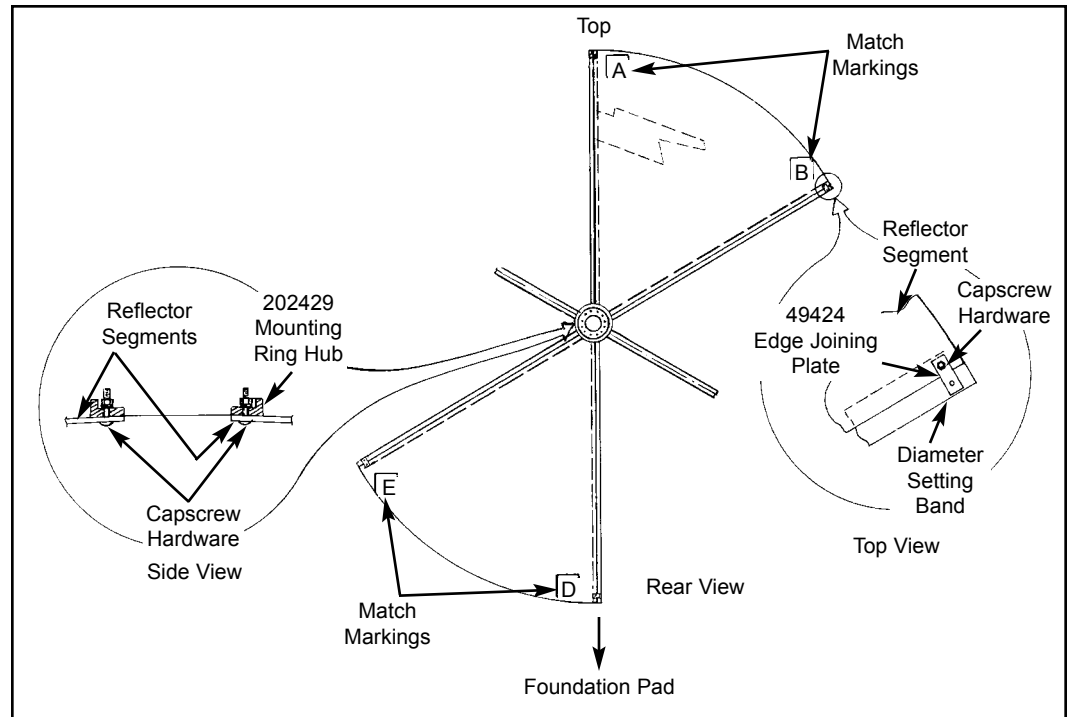


Figure 57

- Step 6** Loosely attach segment **A-F** to mounting ring hub, diameter setting bands, and segment **A-B** using edge joining plates (P/N 49424).

- Place spacers (P/N 200215) between first and third segments
- Insert 1/4-20 capscrews from concave side of reflector segment

ES45T-T Reflector Assembly

Step 7

Loosely attach joining plate (P/N 49693) along **A-A** seam inside reflector rim as shown in Figure 58.

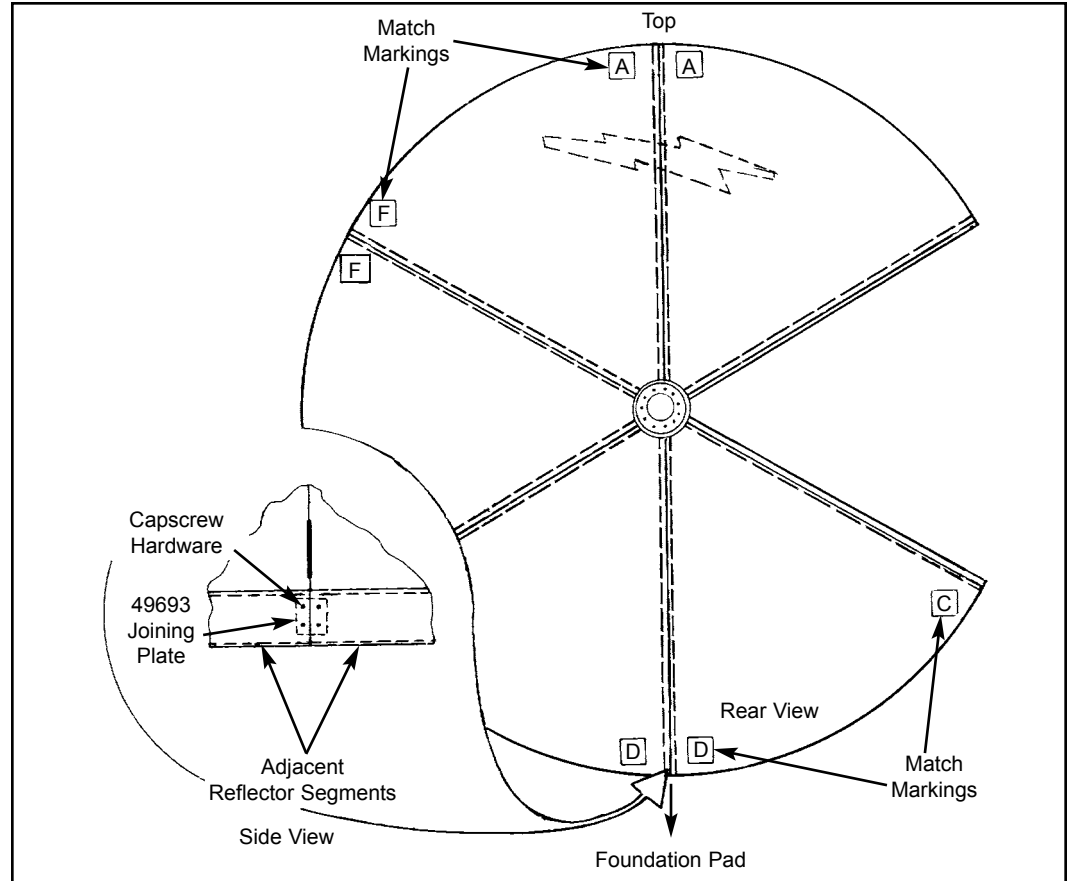


Figure 58

Step 8

Loosely attach segment **E-F** to mounting ring hub, diameter setting bands, and segments **A-F** and **D-E** with joining plates (P/N 49424) on panel seams **E-E** and **F-F**. Loosely attach joining plates (P/N 49693) on rim seams **E-E** and **F-F**.

ES45T-T Reflector Assembly

- Step 9** Station an installer inside reflector to finger-tighten seam hardware and attach final panels as shown in Figure 59.



Figure 59

- Step 10** Loosely attach reflector segment **B-C** to mounting ring hub and diameter setting bands. Use edge joining plate (P/N 49424) on **B-B** panel seam and joining plate (P/N 49693) on **B-B** rim seam.

- Step 11** Before attaching last panel, lift reflector and return temporary supports to initial measuring position. Have installer inside reflector check tension on diameter setting bands. If not uniformly taut, adjust level by adding shims until no segment of the reflector can bounce and bands are uniformly taut, as shown in Figure 60.



Figure 60

ES45T-T Reflector Assembly

Step 12 Install final reflector panel (C-D) by loosely attaching to diameter setting bands and mounting ring hub. Loosely attach panel seam hardware as installer inside moves reflector segment to enable segment union.

Step 13 Begin attaching corresponding reflector rib segments at match-marked position **A-A** using reflector segment seam hardware.

- Insert capscrews from concave side - firmly push bolts through holes until bolt head is flush with reflector surface

Note: Slight pressure on reflector segment may be necessary to enable proper alignment. Do not attempt to thread bolts into holes

Step 14 Insert shim (P/N 200215) between each reflector segment around perimeter of reflector assembly beginning with seam **A-A**. Refer to Figure 28B, Page 27.

Step 15 Begin tightening seam hardware at outer perimeter of reflector starting with seam **A-A**. Continue tightening in concentric circles from reflector rim toward the mounting ring hub.

Note: Near center area it may become necessary to push down on mounting ring hub to narrow segment gap before tightening hardware.

Step 16 Tighten mounting ring hub and diameter setting band hardware. Diameter setting bands should be uniformly taut at this point. If not, add or subtract shims to ensure proper leveling of supports.

Reflector Leveling Procedure

Step 1 Position (6) temporary supports near panel seams exactly as shown in Figure 61. **Note:** Temporary supports should be large enough to adequately support the reflector and strong enough to easily support reflector weight without compressing.

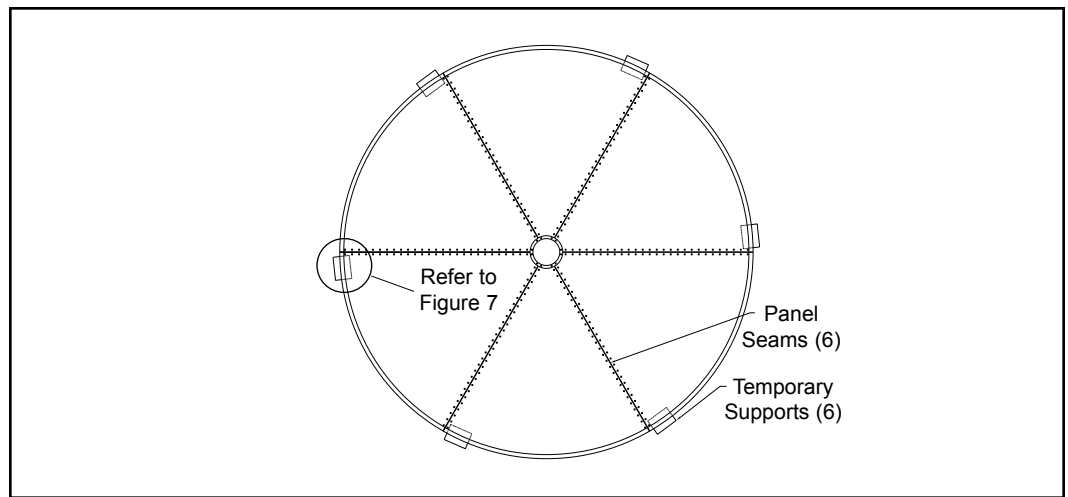


Figure 61

ES45T-T Reflector Assembly

- Step 2** Position theodolite, transit or laser level about 10 feet [3m] from outside perimeter of reflector (see Figure 62).

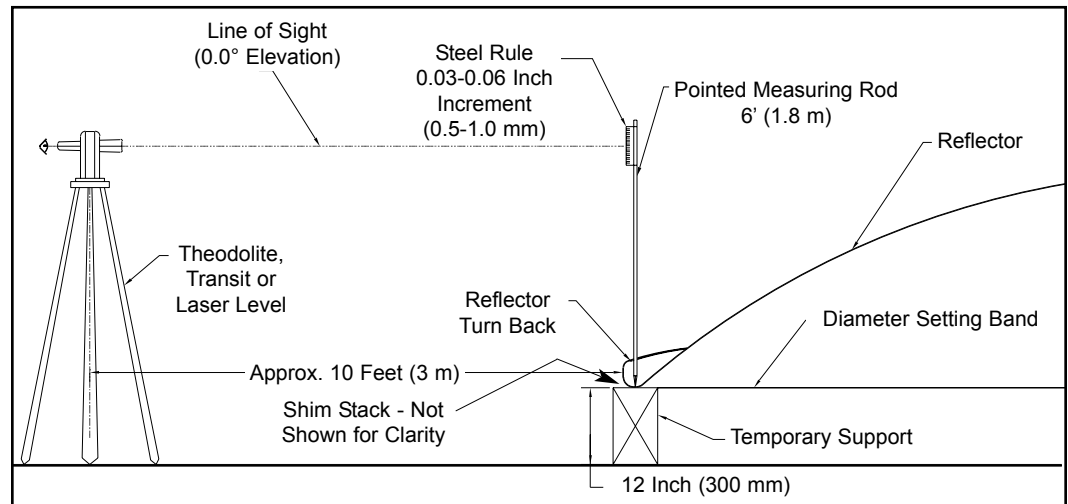


Figure 62

- Step 3** Level theodolite/transit/laser level. If using theodolite, position view scope at 0.0 degrees elevation, lock down elevation adjustment.

- Step 4** Site through theodolite/transit to determine where on measuring rod to place steel rule onto rod to allow visibility of steel rule through theodolite/transit/laser level at all (6) six measurement locations around reflector. Securely fasten both ends of steel rule to measuring rod with adhesive tape (see Figure 62).

- Step 5** Temporary supports should be positioned as shown in Figure 63, close to but not interfering with diameter setting bands.

- Step 6** Referring to Figure 63, mark the measuring location at each of the six temporary support locations with a small dot (use felt tip marker) to be used as reference point in subsequent measurements.

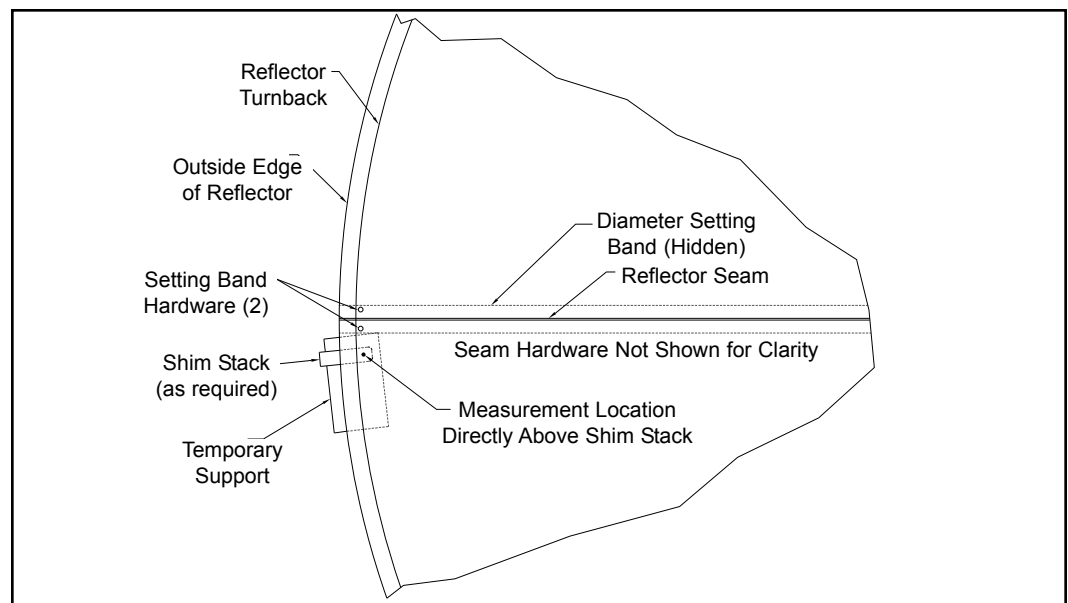


Figure 63

ES45T-T Reflector Assembly

Step 7 Position measuring rod point down over temporary supports and on the flat portion of the aperture face as shown in Figures 62 and 63, using theodolite/transit/laser level carefully measure and record relative height of each of the (6) temporary support locations. **Note:** Measuring rod must be held in a vertical position during all measurements.

Step 8 From the recorded data determine the relative height of each of the locations as compared to the highest measured location. The differences between the highest location and a lower location will be the amount of shim material required to place between the reflector and the temporary support.

Step 9 Shim each location as required to level the reflector (see Figure 63).

Step 10 Continue to measure around antenna again, recording the height of each location measured. As before, shim the low location points to be at the same elevation as the highest measured location.

Step 11 Continue to measure, record, compare and shim any low temporary support location points until all (6) temporary location points are within 0.030 inches [0.75 mm] elevation from each other.

Step 12 Recheck the shim stacks required for leveling the reflector to ensure they are properly positioned and are adequately supporting the reflector. **Note:** As work continues on the reflector it is essential that the shim stacks remain in position through out this process. Also ensure that diameter setting bands are taut and evenly tensioned. If not, check to ensure proper leveling of temporary supports.

Step 13 With the reflector level, tighten seam hardware starting at the outer perimeter of match marked position A-A and continue this procedure around reflector in concentric circles while progressing inward toward reflector center. **Note:** Near center area, it may become necessary to push down on mounting ring hub to narrow segment gap before tightening hardware.

Reflector Center Plate Assembly

Step 1 Install center plate (P/N 49964-2) over reflector center opening and retaining bar (P/N 49997) behind reflector center opening as shown using supplied capscrew hardware as shown in Figure 64.

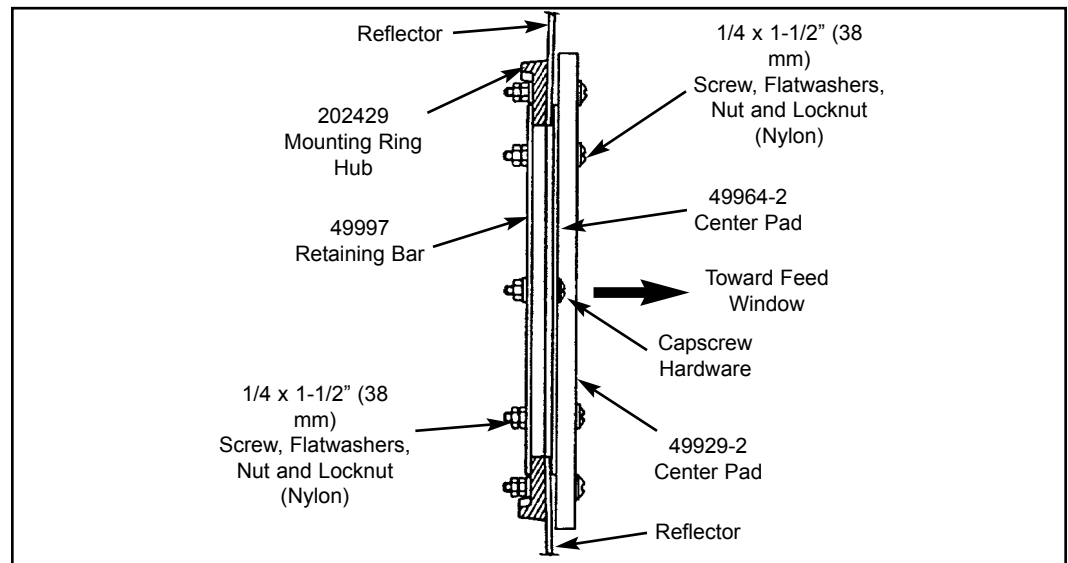


Figure 64

ES45T-T Reflector Assembly

Step 2 Feed Strut Assembly

Step 1

Position white surface of center pad toward feed window and attach pad to center plate using supplied $\frac{1}{4}$ x 1- $\frac{1}{2}$ in. nylon screw, flatwashers and nuts. Install flatwashers under both screw head and corresponding nut as shown in Figure 64. Tighten mounting hardware allowing only slight compression (0.060" max.) of center pad material. Use remaining nylon nuts as locknuts and distort excess screw thread to prevent disassembly.

Loosely attach corresponding feed strut brackets (P/N 49694/49695) to concave side of reflector at points B, C, E, and F as shown in Figure 65.

- Use A-325 $\frac{1}{2}$ x 1- $\frac{1}{4}$ in. bolts, flatwashers and nuts. (see page 12)
- Insert bolts from concave side of reflector

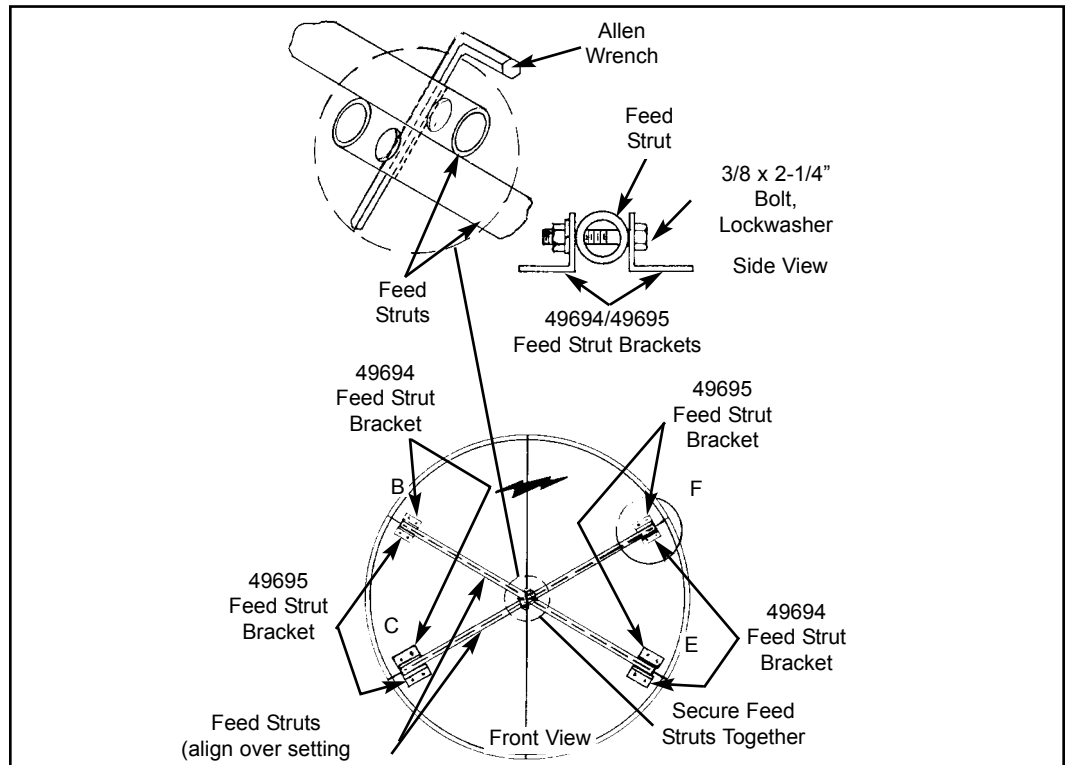


Figure 65

Step 2

Pass feed struts (P/N 221491-1) to installer underneath for attachment to feed strut brackets.

- Use $\frac{3}{8}$ x 2- $\frac{1}{4}$ in. bolts, lockwashers and nuts
- Secure feed struts together at center after attachment to feed strut brackets

You have now completed the assembly of the ES45T-T-1 reflector. The next step in the installation is the assembly of the back structure, which begins in the next section.

ES45T-T Reflector Assembly

ES45T-T-1 Back Structure

The back structure assembly attached to the rear of the reflector. The back structure provides stability for the reflector and maintains the parabolic accuracy of the dish.

Before assembling the back structure, verify that the appropriate parts are present. The following steps provide the procedure for the back structure assembly.

CAUTION: Reflector must remain on level supports positioned under center edge of each reflector segment with diameter setting bands in place during assembly of back structure. Once back structure is attached and all bolts tightened, reflector will be held in its assembled shape. If back structure is added with reflector in distorted shape, back structure will hold reflector in that shape. If standing or walking on reflector becomes necessary, concentrate major portion of body weight towards center of reflector panel.

Step 1

Refer to back structure Figure 66 for positioning and orientation details.

- Apply stick wax (P/N 200852) to A-325 bolt threads before installation to reduce friction. (see page 12)

Note: Do not attempt to tighten A-325 hardware prior to tensioning sequence in assembly procedure.

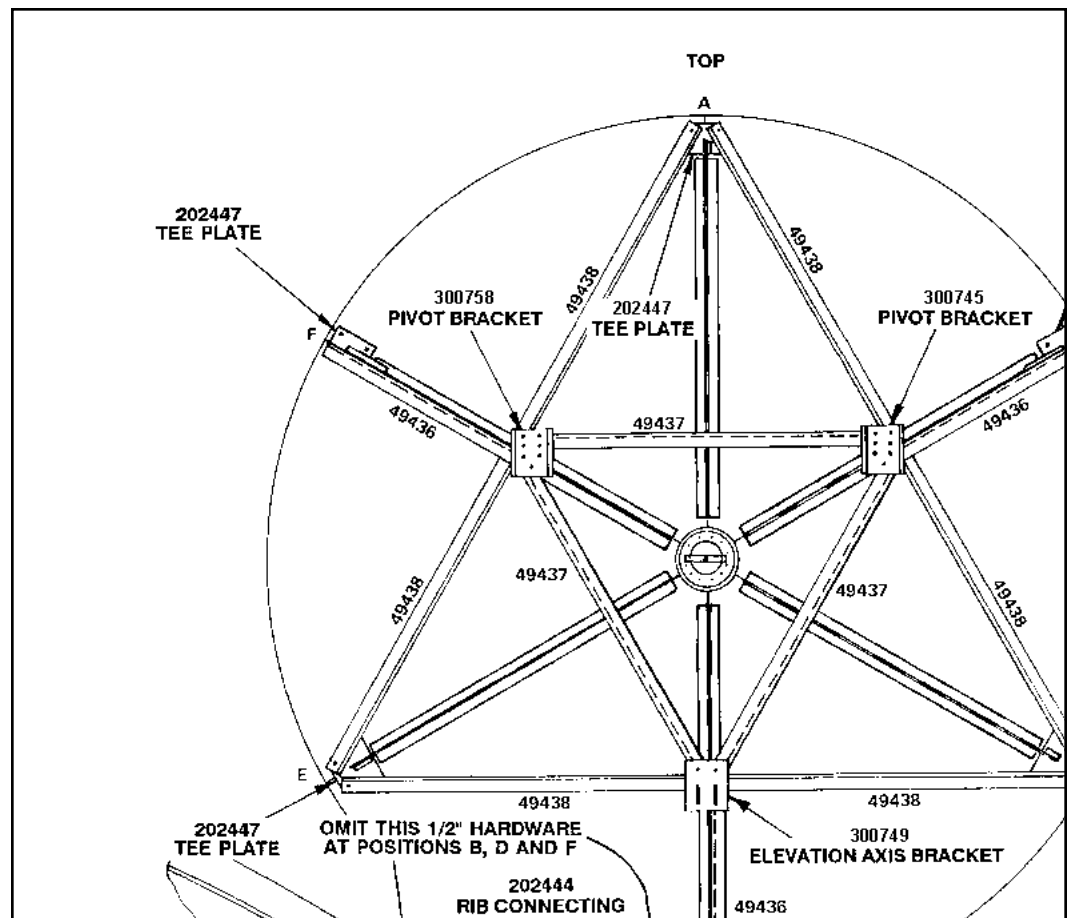


Figure 66

ES45T-T Reflector Assembly

Step 2 Loosely attach tee plates (P/N 202447) and corresponding rib connecting plates (P/N 202444) to points B, C, D, E, and F.

- Use A-325 ½ x 1-¼ in. bolts, flatwashers and nuts. (see page 12)
- Insert bolts from concave side of reflector

CAUTION: Do not install A-325 ½ x 1-¼ in. hardware in center hole of rib connecting plates (P/N 202444) at positions B, D, or F only.

Step 3 Loosely assemble two support angles (P/N 49438) to pivot bracket (P/N 300758). Attach opposite ends of support angles to tee plates (P/N 202447) at points A and E.

- Angle should be installed with edge up and flat of angle toward reflector

Step 4 Loosely attach support angle (P/N 49436) from tee plate at F to pivot bracket (P/N 300758).

- Angle should be installed edge down with flat of angle away from reflector

Step 5 Loosely assemble two support angles (P/N 49438) to pivot bracket (P/N 300745). Attach opposite ends of support angles to tee plates (P/N 202447) at points A and C.

- Angles should be installed edge up with flat of angle toward reflector.

Step 6 Loosely attach support angle (P/N 49436) between tee plate at point B and pivot bracket (P/N 300745).

- Angle should be installed edge down with flat of angle away from reflector

Step 7 Loosely attach support angle (P/N 49437) between pivot brackets (P/N 300745/300758).

- Angle should be installed edge down with flat of angle away from reflector

Step 8 Loosely assemble support angles (P/N 49438) to elevation axis bracket (P/N 49429-2). Attach opposite ends of support angles to tee plates at points C and E.

- Angles should be installed edge up with flat of angle toward reflector

Step 9 Loosely attach support angle (P/N 49436) between tee plate at point D and elevation axis bracket (P/N 49429-2).

- Angle should be installed edge down with flat of angle away from reflector

Step 10 Loosely attach support angles (P/N 49437) between elevation axis bracket and the two pivot brackets.

- Angles should be installed edge down with flat side away from reflector

ES45T-T Reflector Assembly

Step 11 Check diameter setting bands to ensure they are uniformly taut. If not, check leveling of temporary supports and make necessary adjustments by adding or subtracting shims until bands are uniformly taut.

Step 12 Begin A-325 hardware tensioning sequence (see page 12) with tee plates (P/N 202447) and rib connecting plates (P/N 202444). Next tighten support angle (P/N 49436) connections. Tighten the pivot brackets and elevation axis bracket last.

Step 13 Remove diameter setting bands leaving corresponding edge joining plates (P/N 49294) installed using existing hardware.

You have now completed the assembly of the back structure and its attachment to the reflector. Proceed to the next section for instructions on mounting the reflector to the tripod ground mount assembly.

Reflector-To-Mount Assembly (With Crane)

This reflector can be installed on the mount manually or by using a crane. However, Andrew recommends that this procedure be performed using a crane.

The following steps provide the procedure for installing the reflector to the mount using a crane.

Step 1 Ensure all connections on reflector and back structure are tight.

Step 2 Wrap crane straps around support angle between pivot brackets as illustrated by Figure 67.

- Hoist reflector slightly off ground to remove diameter setting bands



Figure 67

ES45T-T Reflector Assembly

- Step 3** Crane should place reflector so that pivot brackets align with support and elevation pivot assembly as shown in Figure 68.



Figure 68

- Step 4** Attach pivot brackets to support and elevation pivot assembly with U-bolts (P/N 9956-65), ½ in. lockwashers and ½-13 hex nuts as shown in Figures 69 and 70.



Figure 69

ES45T-T Reflector Assembly

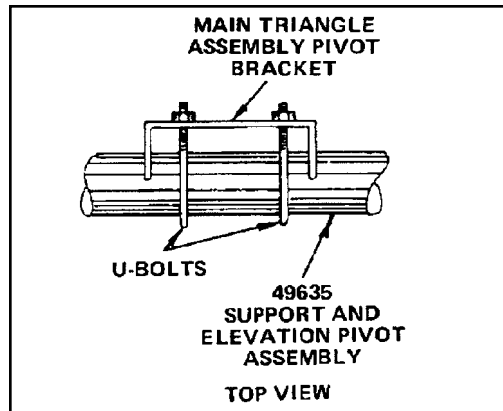


Figure 70

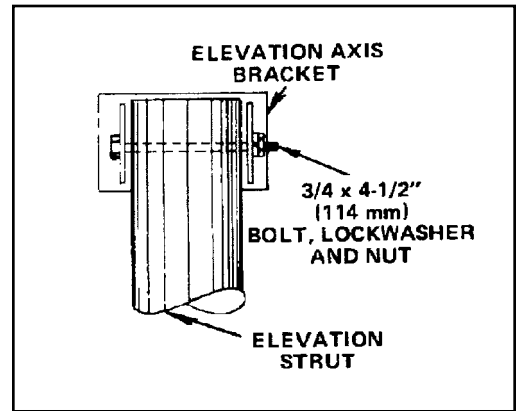


Figure 71

Step 5

Attach remaining end of elevation strut to elevation axis bracket of main triangle assembly as shown in Figures 71 and 72.

- Use 3/4 x 4-1/2 in. bolt, lockwasher and nut



Figure 72

You have now completed the attachment of the reflector to the tripod ground mount assembly. Proceed to the Elevation and Azimuth Adjustments section for instructions on pointing your antenna towards the desired satellite.

ES45T-T Reflector Assembly

Reflector-To-Mount Assembly (With Hoist Kit)

The optional hoist kit (P/N 49080) must be assembled prior to reflector/ backstructure assembly hoisting. Hoist assembly should not be used for antenna elevation angle adjustment. The following steps provide the procedure for installing the reflector with the hoist kit.

Step 1

Install support tab assembly (P/N 49067) into top of azimuth axis support (P/N 49634) as shown in Figure 73.

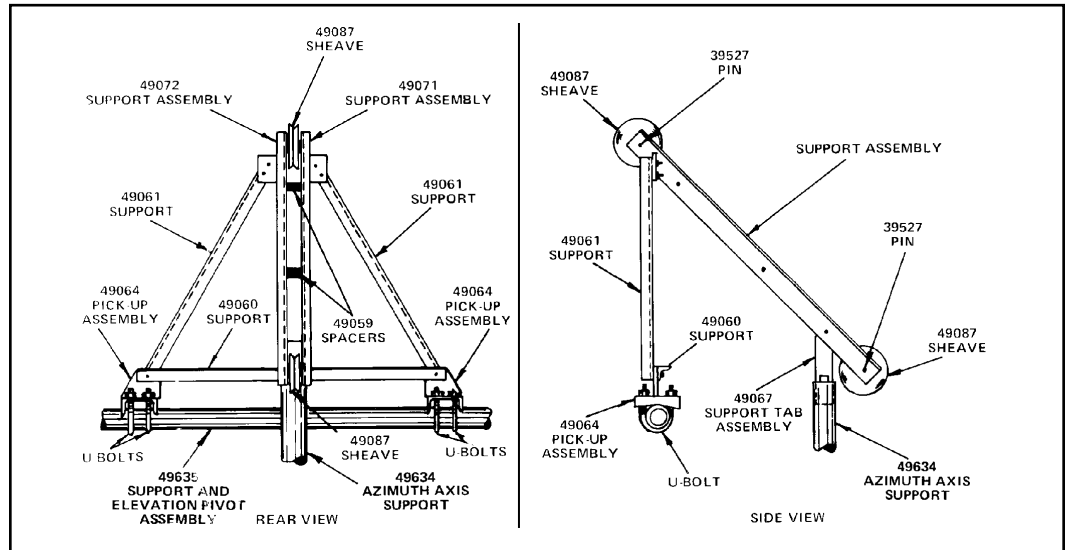


Figure 73

Step 2

Loosely attach corresponding support assemblies (P/N 49071 and 49072) using spacers (P/N 49059) and appropriate hardware (P/N 45980-6).

- Angles should be installed edge down with flat of angles facing upward.

Step 3

Install sheaves (P/N 49087) at each end between support assemblies using pins (P/N 39527) with cotter pins (P/N 9958-6). Securely tighten support assembly hardware.

Step 4

Attach entire support assembly to previously installed support tab assembly (P/N 49067) using appropriate hardware (P/N 45980-6).

Step 5

Loosely attach pick-up assemblies (P/N 49064) to support and elevation pivot assembly (P/N 49635) as shown.

- Use supplied U-bolts with 1/2 inch (13 mm) lockwashers and nuts.
- Pick-up assemblies are mounted with slanted tabs facing outward.

Step 6

Loosely attach supports (P/N 49061) to corresponding tabs on support assemblies (P/N 49071 and 49072) using appropriate hardware (P/N 45980-1).

- Angles are installed edge down with flat of angles facing upward

Step 7

Loosely attach support (P/N 49060) and remaining ends of supports (P/N 49061) to corresponding pick-up assemblies (P/N 49064) using appropriate hardware (P/N 45980-1). Securely tighten all mounting hardware.

- Ensure entire hoist assembly is centered on support and elevation pivot assembly (P/N 49635)

ES45T-T Reflector Assembly

Step 8

Securely attach winch assembly (P/N 39532) to lower portion of azimuth axis support (P/N 49634) using supplied U-bolts, lockwashers and nuts as shown in Figure 74.

- Keep winch cable aligned with sheaves

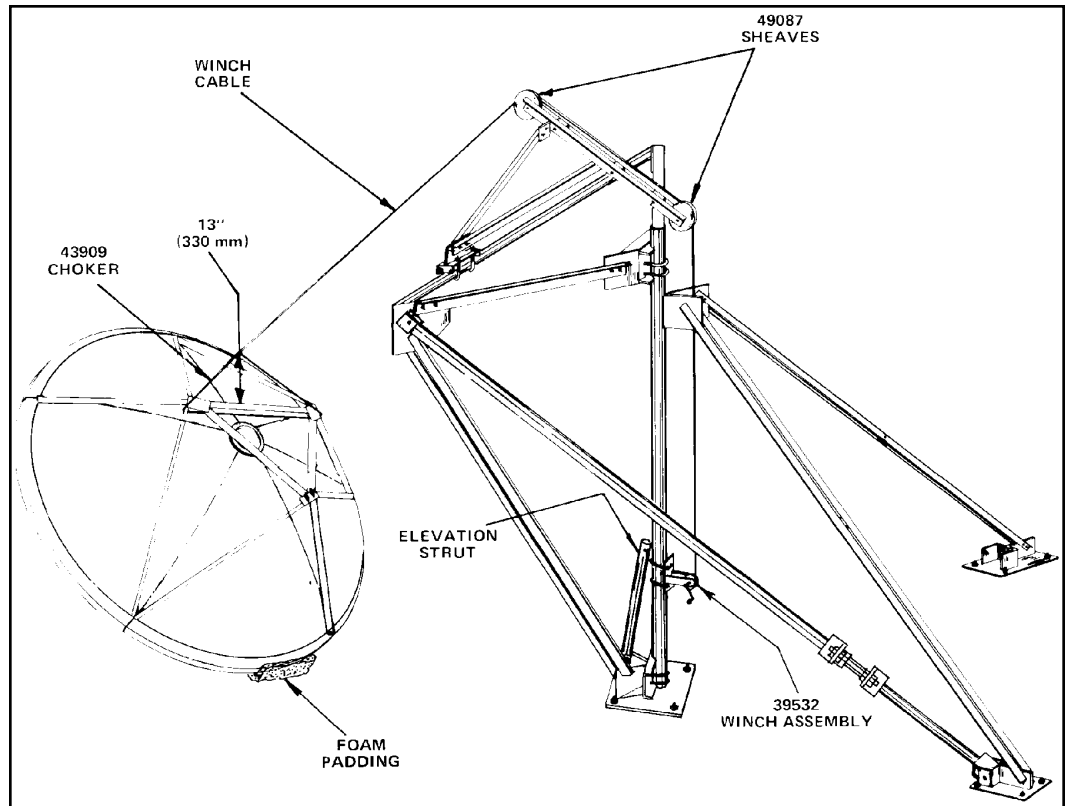


Figure 74

Step 9

Begin releasing winch cable. Route cable through both sheaves allowing sufficient cable length to reach top of main triangle assembly on reflector backstructure.

Step 10

Route P/N 43909 or customer-supplied 18-foot (5500 mm) choker assembly behind both pivot brackets of main triangle assembly as shown. Attach end of choker to winch or crane cable hook.

- Distance between choker/winch connection and top of main triangle assembly should be approximately 13 inches (330 mm).

Step 11

Remove small portion of foam padding from reflector packing crate and install under bottom portion of reflector assembly to prevent reflector damage during hoisting procedure. Position man at bottom of reflector/backstructure to guide assembly during hoisting procedure.

ES45T-T Reflector Assembly

Step 12

Hoist reflector/backstructure assembly to vertical position until upper joints of main triangle assembly contact pipe and straddle two locator bars on support and elevation assembly (P/N 49635) as shown in Figure 75.

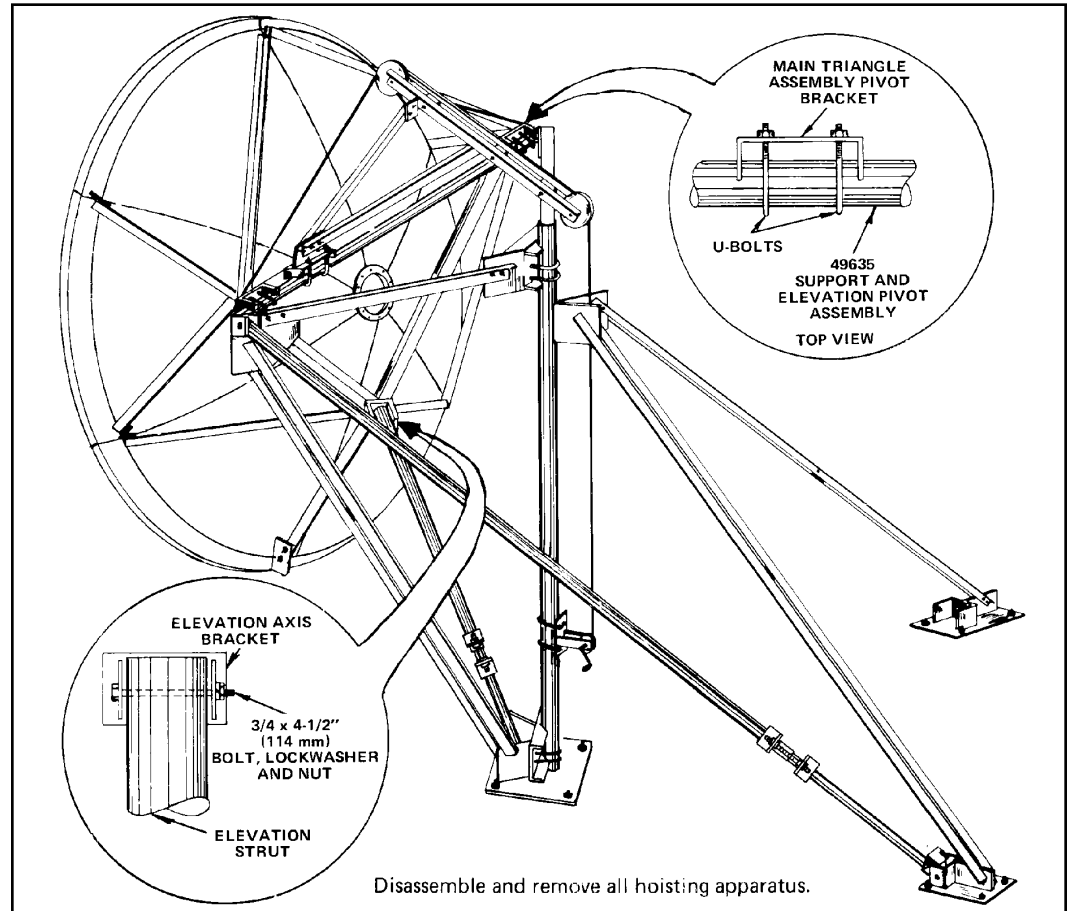


Figure 75

Step 13

Install two U-bolts at each pivot bracket of main triangle assembly.

- Use 1/2 inch (13 mm) lockwashers and nuts.
- Securely tighten U-bolts allowing for some reflector movement

Step 14

Raise lower portion of reflector/backstructure assembly and attach remaining end of elevation strut to elevation axis bracket of main triangle assembly.

- Use 3/4 x 4-1/2 in (114 mm) bolt, lockwasher and nut
- Mechanical means or fine adjustment assembly may be utilized to achieve elevation angles greater than 300.

ES45T-T Reflector Assembly

Step 15 Set fine elevation and azimuth strut positions based on the procedure performed in the Elevation and Azimuth Adjustment section.

- If fine alignment is not performed at this time, continue the assembly procedure at Step 16.

Step 16 Securely tighten U-bolts and elevation strut mounting hardware.

Step 17 Remove both fine adjustment assemblies and store in a weather protected location for future use. Continue with feed system and corresponding LNA installation.

You have now completed the attachment of the reflector to the tripod ground mount assembly. Proceed to the Elevation and Azimuth Adjustments section for instructions on pointing your antenna to its satellite.

Elevation and Azimuth Adjustments

Step 1 Proper antenna pointing requires specific coarse and fine elevation and azimuth strut length adjustments which can be determined using the graphs provided in Appendix F. Adjustable azimuth and elevation struts are initially set in coarse setting as near as possible to pre-determined lengths. Fine elevation and azimuth settings are accomplished with threaded rod on elevation and azimuth struts.

CAUTION

Never loosen strut set screws and fine adjustment assembly U-bolts simultaneously. Doing so may result in severe bodily harm and equipment damage.

Step 2 **Coarse Elevation Adjustment.** Station at least two installers at reflector rim to provide temporary reflector support while third installer loosens two U-bolts on each end of elevation pivot assembly (P/N 49635) and removes 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut connecting elevation strut to bottom of main triangle assembly. Carefully lower reflector to vertical position.

Step 3 Determine required length of elevation strut to nearest degree increment of desired elevation setting. Adjust coarse elevation setting by withdrawing secondary and, if necessary, tertiary strut sections from primary strut to achieve required strut length. Install eight 1/2 inch (13 mm) set screws in holes provided and securely tighten. **Note:** Do not extend secondary or tertiary strut sections into red warning areas.

Step 4 Carefully raise reflector and attach elevation strut to bottom of main triangle assembly using previously removed 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut. **Note:** Mechanical means or fine adjustment assembly may be used to achieve elevation angles greater than 30°.

Step 5 **Coarse Azimuth Adjustment.** Loosen to U-bolts on both upper (P/N 49630) and lower (P/N 49629) azimuth axis joints. Remove 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut connecting azimuth strut to U-bracket (P/N 49704).

ES45T-T Reflector Assembly

Step 6 Determine required length of azimuth strut to nearest degree increment of desired azimuth setting. Adjust coarse azimuth setting by withdrawing secondary strut section from primary strut to achieve desired strut length. Install four 1/2 inch (13 mm) set screws in holes provided and securely tighten. **Note:** Do not extend secondary strut section into red warning area.

Step 7 Carefully pivot reflector as required and attach azimuth strut to U-bracket using previously removed 3/4 x 4-1/2 inch (114 mm) bolt, lockwasher and nut. **Note:** Apply grease (P/N 49208) around bottom area of lower azimuth axis joint assembly (P/N 49629) before changing azimuth position of antenna.

Step 8 **Fine Adjustment.** Attach fine adjustment assembly between adjacent elevation strut sections as shown in Figure 76 using appropriate brackets, U-bolts, brass hex nuts, flatwashers and threaded rod. Securely tighten all adjustment assembly hardware. **Note:** Adjustment assembly may also be attached in alternate position shown depending on required elevation angle.

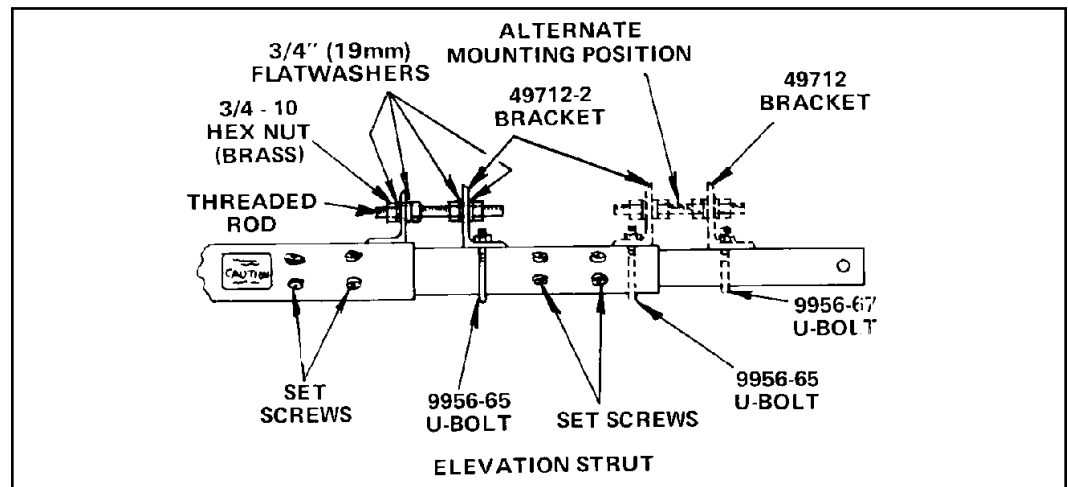


Figure 76

Step 9 Attach fine adjustment assembly between adjacent azimuth strut sections as shown in Figure 77 using appropriate brackets, U-bolts, brass hex nuts, flatwashers and threaded rod. Securely tighten all adjustment assembly hardware. **Note:** Fine adjustment assembly on azimuth strut should be positioned away from ground mount angles.

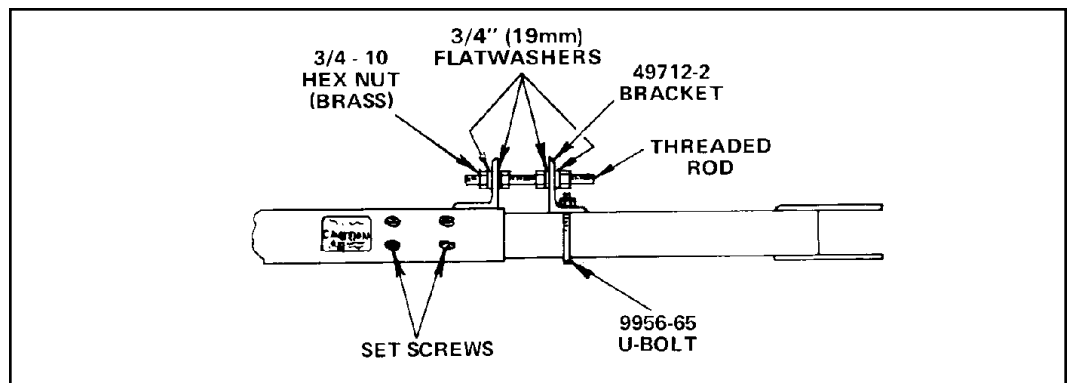


Figure 77

Step 10 Set fine elevation and azimuth strut positions by loosening strut set screws and selected out fine adjustment hex nut. Turn corresponding inner hex nut in appropriate direction until required strut length is achieved. Securely tighten strut set screws and corresponding outer hex nut.

Step 11 During final electrical tuning, adjust elevation and azimuth struts appropriately to lengthen or shorten struts for optimal signal strength.

Step 12 After fine adjustments are complete, ensure strut set screws are securely tightened and spray with zinc-rich paint. Securely tighten hex nuts and U-bolts on both elevation and azimuth fine adjustment assemblies.

Step 13 Securely tighten eight U-bolts on elevation pivot assembly and upper and lower azimuth axis joints.

Step 14 Remove both fine adjustment assemblies and store in weather protected location for future use.

You have now finished aiming your antenna at the desired satellite. Proceed to the Feed Installation instructions packaged with the feed assembly for information on assembling and attaching the feed assembly to the reflector.

By now, you can see that your installation of the 4.5-Meter Earth Station Antenna is almost complete. The feed system is the last phase of the base installation described in this manual.

Feed Support/Strut Assembly

Note: All antenna options (such as feeds, shields, anti-icing, etc.) possess installation instructions within the individual kits contained in the shipment.

Step 1 Attach feed struts to 222930 feed support as shown in Figure 78.

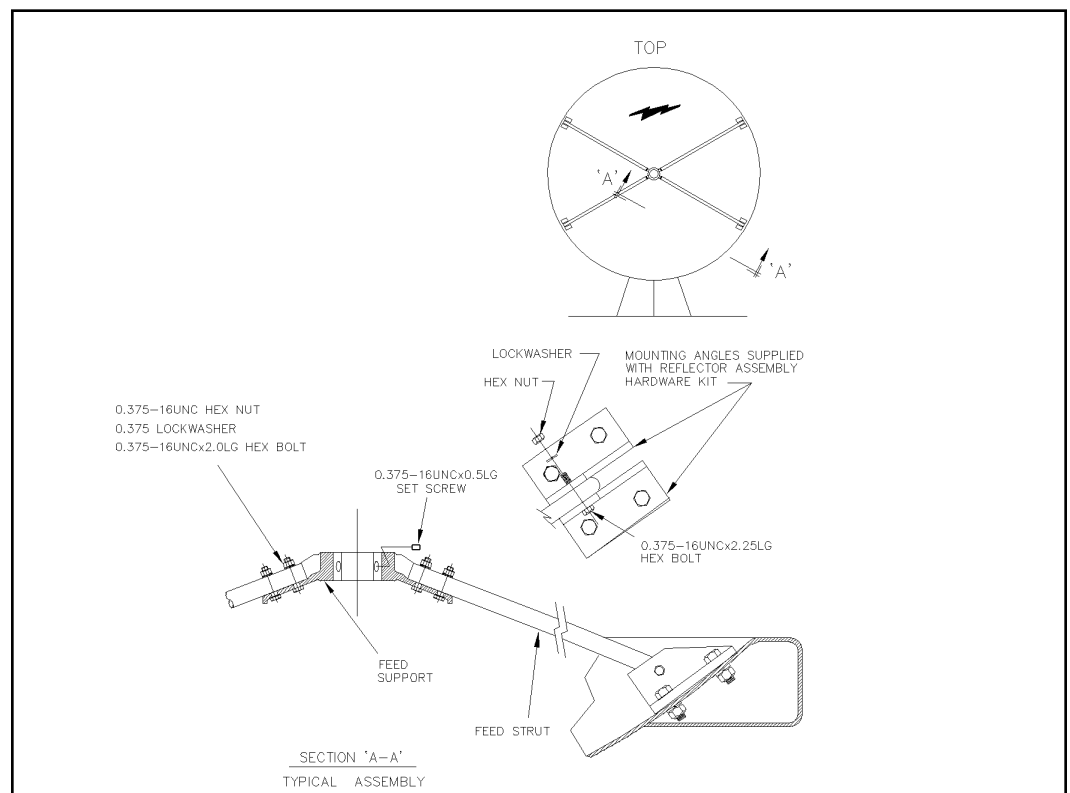


Figure 78

Step 2

Securely tighten all feed support strut mounting hardware.

Polarization Adjustment

Step 1 Connect receive LNA output to spectrum analyzer and fine adjust elevation and azimuth strut lengths to achieve maximum signal strength from desired satellite.

Step 2 Loosen four 3/8 x 1/2 in. set screws in feed support until feed assembly is free to rotate and adjust feed for maximum receive signal strength on desired polarization.

Note: Do not loosen collar hardware (P/N 49795). Collar will maintain appropriate feed window to center pad dimension during polarization adjustment.

Step 3 Rotate feed assembly in one direction until signal level drops 1 dB. Mark this position. Rotate feed in opposite direction through maximum signal until signal level again drops 1 dB. Mark this position.

Step 4 Adjust feed assembly to midpoint of 1 dB marks and securely tighten four 3/8 x 1/2 in. set screws in feed support making sure feed support is firmly seated against collar.

You have now completed the feed installation for your Earth Station Antenna. Refer to the appropriate section for the calculations necessary for antenna pointing.

**Medium Modular
Mount**

Refer to bulletin 237151C, for Installation Instructions.

Operation

Overview

After you have completed the assembly of your antenna, you are now ready for it to become operational. In order to operate the earth station antenna, you will need to direct it to the desired satellite adjusting both the elevation and azimuth angles appropriately. The following procedures provide details on how to correctly position your antenna on the desired satellite.

Acquiring A Satellite

Follow the procedures listed below when acquiring the desired satellite:

Note: Ensure that the feed system and all electronics are installed properly before proceeding.

Step 1

Evaluate and determine the required elevation and azimuth angles for the satellite of interest.

Steps 2 through 6 are for Pedestal Mounted Antenna Only

Step 2

Loosely attach the manual actuator assembly (P/N 207882) to the elevation strut as shown in Figure 100b using the appropriate hardware.

Note: The drain hole should be positioned downward for proper water drainage.

Step 3

Ensure that the locking strut-support setscrew is firmly tightened on the strut assembly as shown in Figure 100b.

Step 4

Remove the two indicated strut-support setscrews, and attach the base angle to the corresponding strut support using the supplied 1/2 inch clamping nuts and the previously removed strut-support setscrews as shown in Figure 100b.

Step 5

Securely tighten the remaining mounting hardware to achieve sufficient clamping force.

Step 6

Repeat the entire process for the remaining strut assembly. **Note: DO NOT** loosen the azimuth drive bearings.

Step 7

If you have a pedestal mounted antenna, move the antenna to the desired azimuth angle by adjusting the manual actuator until the satellite signal has been spotted. If your antenna is mounted upon a tripod, adjust the azimuth strut length through the fine adjustment assembly until the satellite signal has been spotted.

There are several procedures that may be used to properly acquire the satellite. Andrew recommends that a spectrum analyzer be used. The following procedures provide explanations as to how to use the spectrum analyzer.

While viewing the spectrum analyzer screen, a pure noise signal as shown in Figure 1 will probably be observed. Additionally, some transponder signals may be observed above the noise signal as shown in Figure 2.

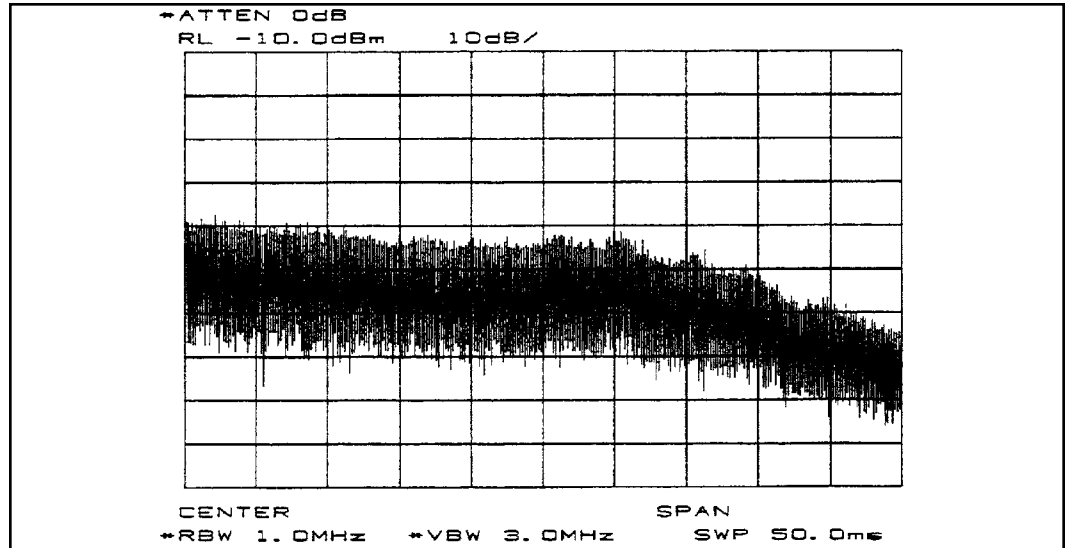


Figure 1

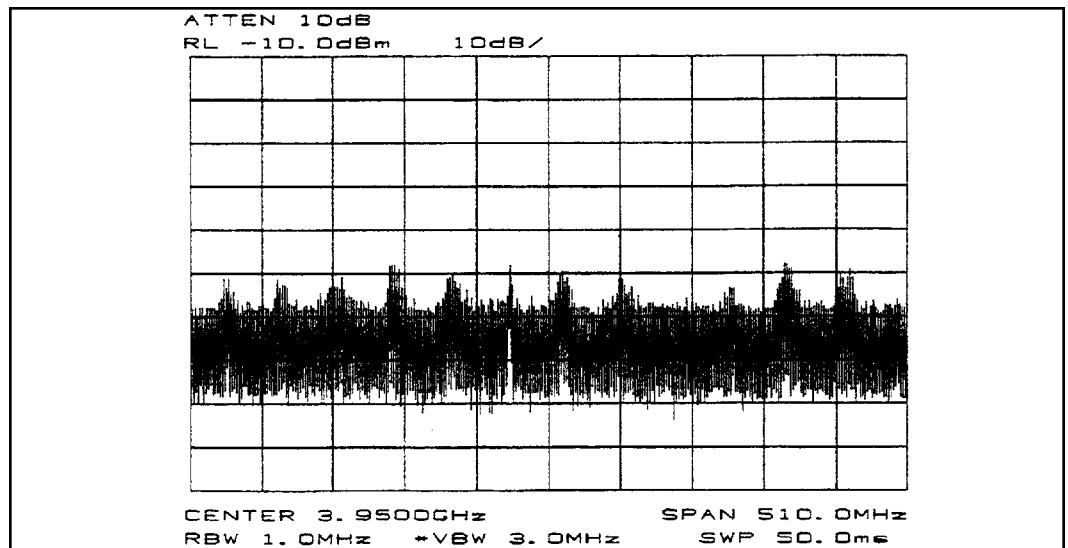


Figure 2

The following steps provide the procedure for acquiring a satellite.

Step 1

Manually move the antenna in the azimuth (scanning back-and-forth) to achieve the maximum (greatest amplitude) transponder signals.

- Scan in one direction until the amplitude continues to diminish and then scan in the opposite direction until the same condition occurs.
- Return to the position yielding the greatest amplitude.

The maximum azimuth excursion from the original setting should not exceed $\pm 1.5^\circ$ or the antenna may begin to access a different satellite.

Step 2 With the antenna positioned in azimuth such that the transponder signals are maximized, follow the same procedure manually moving the antenna in elevation (scanning up-and-down) to further maximize the transponder signals.

Step 3 Repeat this procedure alternating between the azimuth and elevation excursions of the antenna to peak the transponder signal amplitude.

A transponder signal amplitude of 30 dB or greater from peak to average noise signal indicates the antenna is receiving the signal on the main beam. A transponder signal amplitude less than 30 dB indicates the antenna is receiving the signal on the side lobe of the main beam.

Step 4 With the antenna peaked on a side lobe in azimuth and/or elevation, move the antenna in azimuth while observing the spectrum analyzer screen as shown in Figure 3.

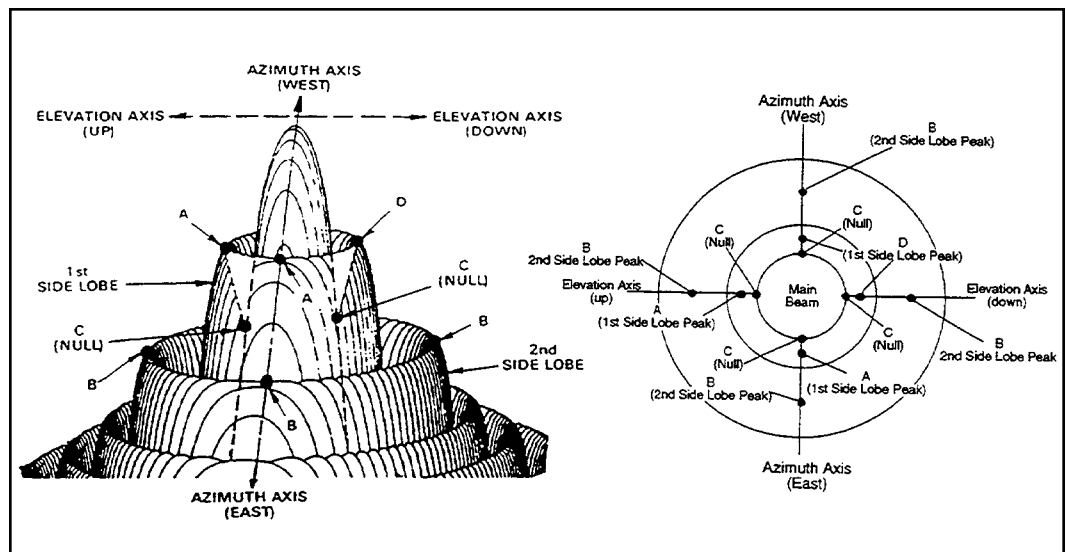


Figure 3

Step 5 If the signal amplitude diminishes and does not increase (position B) to the level noted when the antenna was peaked on the side lobe, the antenna is moving away from the main beam; reverse the direction of the antenna movement.

From the original side lobe position (position A), the signal amplitude should now diminish to a null point at position C (minimum amplitude showing only signal noise) and then symmetrically increase again to the same level at position D as noted at position A. At the null point (position C), the antenna is aligned with the alternate (elevation) axis. If the antenna was peaked on a side lobe in the azimuth, it was appropriately aligned with the elevation axis; proceed with Step 6. If the antenna was peaked on a side lobe in elevation, it was appropriately aligned with the azimuth axis; proceed with Step 6 moving the antenna in azimuth rather than elevation.

Step 6 Move the antenna in elevation while observing the spectrum analyzer screen. If the signal amplitude increases, decreases and then increases again but to a lesser value, the antenna is moving in the wrong direction; reverse the direction of the antenna movement. From the original null point, the signal level should decrease and increase alternately, but with an increasing amplitude until the transponder signal increases to a level of at least 30 dB. Continue to manually peak the signal to a maximum level using the azimuth and elevation adjustments.

Step 7 If the antenna is aligned in azimuth and elevation (signal maximized) and 24 transponder signals (12 horizontal and 12 vertical) are noted, the polarization adjustment is set incorrectly and must be modified. If 12 transponder signals are noted, they may or may not be the properly polarized signals. Therefore 24 transponder signals must be visually noted in order to determine the proper polarization setting.

Step 8 Rotate the feed assembly clockwise until 24 transponder signals are noted and of approximately equal amplitude. **Note:** It is more accurate and visually easier to minimize the alternate set of transponder signals rather than maximizing the transponder of interest.

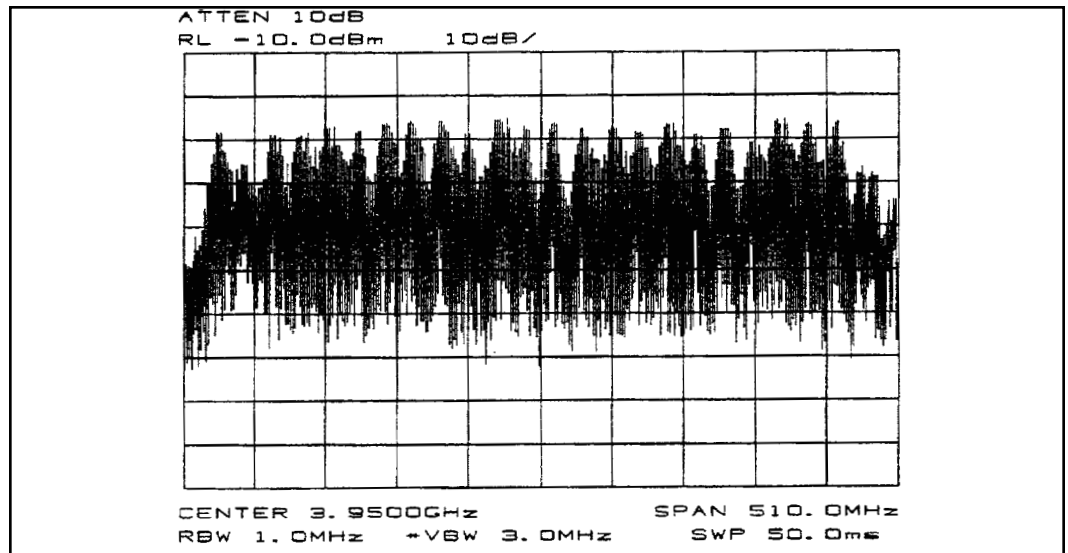


Figure 4

Step 9 With all 24 transponder signals of approximately equal amplitude appearing on the spectrum analyzer screen determine the specific antenna system and satellite parameters. Rotate the feed assembly as required until the appropriate (odd or even) transponder signals are maximized.

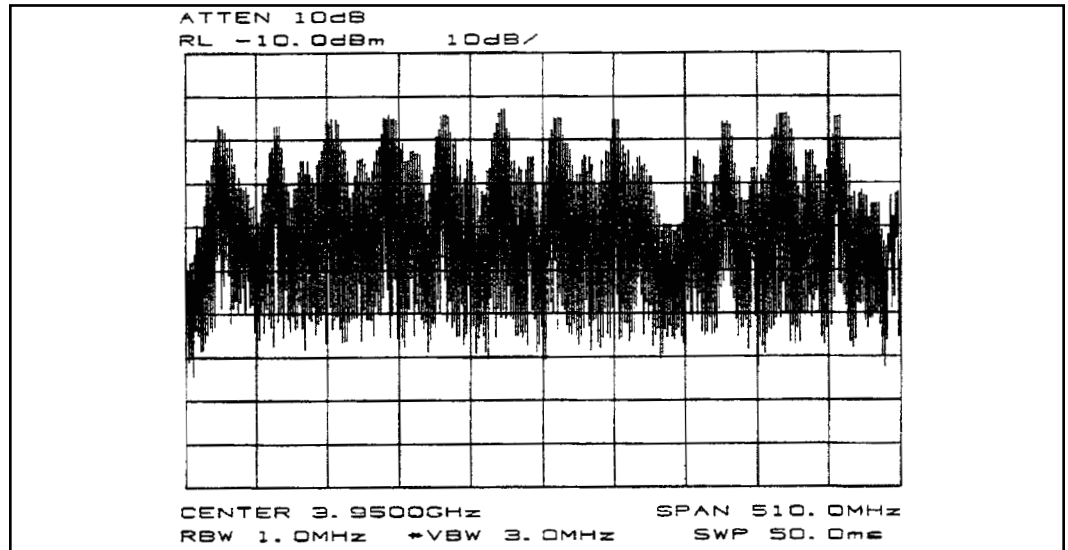


Figure 5

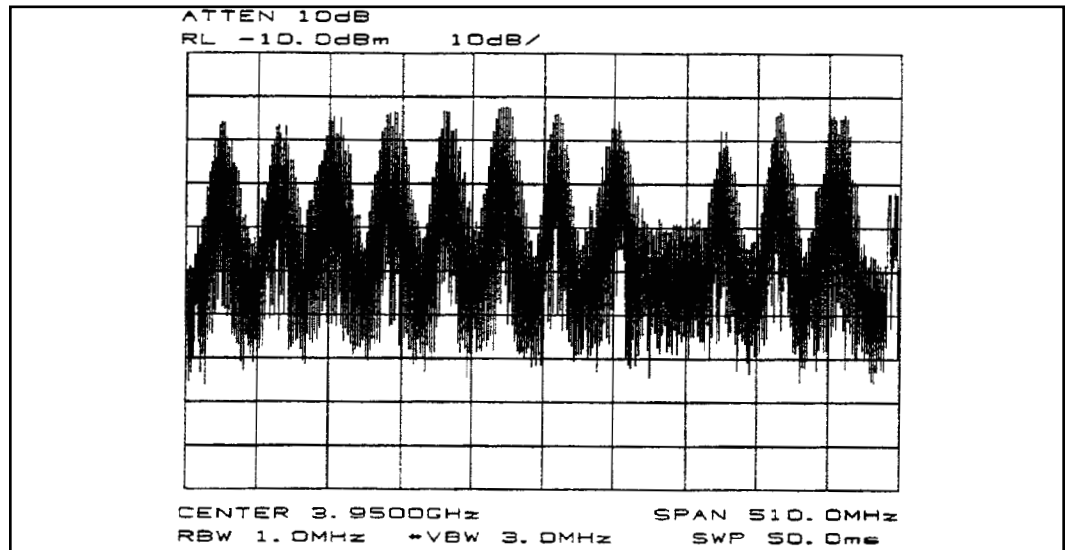


Figure 6

Manual Actuator Assembly Removal

Step 1

After you have successfully acquired the satellite and all adjustments have been made, the manual actuator should be removed. The following steps provide the procedure for the proper removal of the manual actuator assembly.

Remove the manual actuator assembly by first removing the hardware securing the actuator to the base angle. **Note:** The adjustment kit assembly should be removed after the antenna has been adjusted. Store the manual actuator assembly and the corresponding hardware in a dry area for future use.

Step 2

Remove the remaining clamp segments with the corresponding hardware.

Step 3

After the antenna is pointed at the satellite, tighten all azimuth and elevation setscrews to 35 foot-pounds.

Preventive Maintenance

Overview

This section contains periodic preventative maintenance instructions for the 4.5-Meter Earth Station Antenna. Included in this section are inspection and preventative maintenance procedures including cleaning and lubrication, painting and an operational voltage/current checkout procedure deemed within the capabilities of the average station technician. Refer to applicable vendor manuals for any repair procedures not included in this section yet designated as capable of being performed in the “field” rather than requiring specialized facilities, tools and/or test equipment as well as technically trained personnel.

An operational checkout procedure provides an accurate indication of the overall earth station performance and should be performed at intervals of approximately three months. This procedure is essentially performed during the various modes of normal operation of the earth station. In addition, the operational checkout procedure should be performed after any repairs or adjustments have been made, or whenever the earth station is suspected of degraded operation. If any discrepancy in performance exists and the condition cannot be readily remedied to return the earth station to a proper operating condition, the appropriate troubleshooting procedures should be referenced to locate the fault. After the trouble is determined and the repairs effected, a final operational checkout procedure should be performed to verify that all discrepancies have been corrected.

The following paragraphs describe the inspection and preventative maintenance procedures for the earth station. These instructions include general cleaning and inspection, the preservation of metal parts and the lubrication of moving parts. Periodic replacement of assemblies or components as a preventative measure is not required. Malfunctions of the earth station can be traced to components, assemblies and parts through the use of applicable troubleshooting procedures.

General Cleaning

To prevent the excessive accumulation of dust and dirt as well as the removal of such contaminants, thoroughly clean the equipment whenever visually inspecting the earth station components. No special cleaning procedures are required. However, a thorough cleaning in accordance with the following procedures is required to assure continued trouble-free operation.

Electrical Parts

Minor cleaning, such as the removal of dust and loose foreign particles can be accomplished by one of the following:

- Vacuuming
- Using a soft brush or lint-free cloth
- Blowing out the dust and dirt with low pressure (5 to 25 psi), dry compressed air

When using air to blow off the contaminants, either avoid or be careful when directing the air stream on delicate parts. To remove imbedded dirt, grease or oil from electrical parts: use a 50% solution of isopropyl (rubbing) alcohol and apply with a soft bristle brush. It may be necessary to brush some parts vigorously with a stiff bristle brush to remove imbedded and hardened dirt particles. If possible, avoid excessive use of cleaning solvent on electrical insulation. After cleaning, allow the cleaned parts to dry for 10 to 15 minutes before placing the equipment into operation.

Clean mechanical parts by first removing dust, dirt and other loose contaminants with a

Mechanical Parts

scraper, stiff brush (bristle, or wire in the case of rust or corrosion), or cloth or compressed air at 25 to 40 psi. Any accumulated imbedded dirt, corrosion, grease or oil deposits that require further cleaning may be removed with a bristle or wire brush and a cleaning solvent such as trichlorethylene or equal. After cleaning, allow cleaned parts to dry for 10 to 15 minutes before placing the equipment into operation.

Inspection

The frequency of inspection is contingent upon the user's individual standards and the operational environment in which the earth station is located. However, a visual inspection of the earth station components should be performed at least semi-annually. Where there are no established wear limits, perform a visual inspection to locate worn or damaged parts which could cause improper functioning of the earth station. It is recommended that the mechanical and electrical inspection be performed on the assembled or partially disassembled equipment to determine the extent of disassembly required prior to completely disassembling a suspected malfunctioning component or module. In the absence of any special inspection requirements, operational tests are the most effective means in isolating parts and assemblies requiring further inspection. Any condition noted during inspection that may preclude continued proper operation of the earth station prior to the next scheduled inspection should be noted. The discrepant condition should be corrected (repaired or replaced) immediately or at the conclusion of the inspection procedure.

Local Control/Motor Drive Controller

Inspection of the local control/motor drive controller conforms generally to standard visual inspection procedures on electromechanical equipment. In addition to these standard procedures, perform the following checks and visual inspections for the specific conditions noted:

WARNING

Care must be taken to avoid electrical shock. Failure to heed warning could result in injury or death.

- Check the main panel for illegible and indistinct panel markings.
- Connect the detachable hand controller assembly (local control) for visible signs of damage such as cracked housing, damaged connector/bent pins, cuts or damage to cable jacket insulation, etc. Examine selector switches for damage and proper actuation movement.
- Inspect all wiring and cables for discoloration and burned insulation, dirt, breaks, security of connection and other signs of deterioration. Examine connections for dirt, flux, corrosion and mechanical defects. Check for loose or broken lacing and cut, brittle, abraded, frayed or cracked insulation.
- Examine connectors for corrosion, broken inserts and stripped threads. Check connector shells for distortion and dents, and contact pins for bends, misalignment or other deformities. Check connector inserts for carbon tracking indicating arc-over.

- Check all electrical components for dirt, chips, cracks, breaks, discoloration or other signs of deterioration and damage. A discolored, blistered or burnt condition is evidence of overload. Measure actual value of suspect electrical components and compare against specified value where applicable.
- Check transformer for an excessive wax deposit on the surface, discoloration or a pungent odor indicative of burning varnish denoting overheating or a total breakdown.
- Check all terminal blocks for broken or missing terminals and stripped threads. Check tightness of lead attaching hardware.

Caution

Make sure electrical power has been disconnected.

- Check the motor starters and circuit breakers for free operation. Check tightness of all wire connections.
- Visually inspect printed circuit board for signs of debris that might short out components. Verify that all LED indicators are functioning correctly. Check the terminal block connectors for tightness of lead attaching hardware and signs of scorching or burning.
- Check for security of all hardware and stripped or otherwise damaged threads. Check metallic parts for corrosion, dents, distortion and other deformation.
- Check for evidence of water inside the enclosure. If any water is in evidence, check that all seals are intact and if not, use a coating of RTV-108 (silicone rubber sealant) to seal any exposed electrical fitting, bolt hole or other possible water entry into the enclosed electrical components in order to maintain a water proof condition.
- Check or change vapor corrosion inhibitor unit.

Antenna

Inspection of the antenna conforms generally to standard visual inspection procedures performed on electromechanical equipment. In addition to these procedures, perform the following checks and visual inspections for the specific conditions noted:

- Inspect all wiring and cables, particularly the network to enclosure and enclosure to mount interfaces, for discoloration and burned insulation, moisture entry, corrosion, dirt, breaks, security of connection, and other signs of deterioration. Examine connections for dirt, corrosion and mechanical defects. Check for loose or broken lacing and cut, abraded, frayed, brittle and cracked insulation.
- Examine connectors for corrosion, broken inserts and stripped threads. Check connector shells for distortion and dents, and contact pins for bends, misalignment or other deformities. Check connector inserts for cracks, carbon tracking, burns or charring indicating arc-over.

- Check all electrical components for dirt, cracks, chips, breaks, discoloration and other signs of deterioration and damage. A discolored, blistered or burnt condition is evidence of overload.
- Operate the azimuth and elevation drives as well as the feed rotation in both the plus and minus direction from the local control/motor drive controller at least once every three months during antenna down time. Check the mechanical limit switches provided at the end points stop antenna and feed movement, and limit travel to prevent structural interference and damage. Check the mechanical limit switches for corrosion and water entry and the arm on each feed limit switch for free movement without binding. Be certain both feed rotation limit switch arms are not distorted and ride centrally on the actuating cam to open their corresponding limits switch.
- Inspect the azimuth and elevation jackscrew boots for security of attachment at both ends, for abrasion, tears, cuts, brittleness and other damage that may expose the jackscrew to the environment (water, dust, etc.). Minor repairs can be made with RTV-108 silicone rubber sealant.
- Visually inspect the feed window for dirt and the feed, feed supports, feed window and reflector for distortion, foreign object damage and environmental deterioration due to ice and snow, dust, rain, hail and high winds, etc. which may cause electrical component and/or structural deformation.
- Check the cable attachment to the resolvers and to the LNA or LNAs and enclosure mount interface for security, the cable routing for secure hanger attachment and the cable insulation for cuts, cracking, abrasion and other deterioration. Check the LNA or LNAs and the resolvers for a secure mechanical attachment. Ensure proper torquing of polarization drive gear box setscrews and appropriate tensioning of corresponding drive chain assembly, if applicable.
- Check (if applicable) that the drain holes in the bottom of the enclosure are not obstructed and there is no evidence of water accumulation. Check the enclosure doors for proper closure and that the door seals are intact, not torn, abraded or otherwise damaged. Check that all other seals are intact and if not, use a coating of RTV-108 (silicone rubber sealant) to seal any exposed electrical fitting, bolt hole, or other possible water entry to electrical components in order to maintain a weatherproof condition. If the enclosure is provided with a vent fan, check for free operation of the fan blade. The fan bearings are permanently lubricated; any binding, abnormal noise or vibration necessitates replacement of the fan assembly. Check and replace the fan filter element if it appears dirty or obstructed with dust.
- Check for the appearance of surface lubricants that will cause the accumulation of dirt and grime. Clean off all excess surface lubricants with a cloth and, if required, a cloth dampened (not wetted) with trichlorethylene, or equal.
- Visually inspect all mechanical parts for freedom of operation with no misalignment, binding or interference. Check all cabling for sufficient slack to prevent cable strain as well as adequate restraint to prevent abrasion or chaffing during antenna and feed movement.

Drive System Voltage and Current Checks

- Check security of antenna mounting and interconnecting assembly hardware. Be certain all electrical grounding connections (including cross-axis grounding straps) and intact and secure, not corroded or broken. Thoroughly clean any noticeable corroded portions of grounding cables, unplated portion of universal terminals and corresponding mounting surfaces with a wire brush. Replace rather than tighten any loose A-325 structural hardware. The hardware distorts at initial installation and once loosened will not maintain the required high strength friction connection. All other assembly and installation hardware should be tightened to its original torqued condition. When installing new structural hardware, do not use a wrench with a lever arm longer than two feet.
- Examine painted aluminum and galvanized surfaces and touch-up where required.

At the conclusion of the installation procedure and prior to turning the system over to the station facility, an installation acceptance check-off sheet was prepared and duly signed off if installed by an Andrew crew. Part of this check-off included voltage readings retaken to determine if proper voltage was available. Current readings were also taken as a reference for future comparison to serve as a troubleshooting aid in determining possible equipment degradation and shortened life. Any current reading taken during the following procedure that significantly varies by more than five percent from the preestablished reference values necessitates trouble shooting the particular system involved to determine the cause and required corrective action.

Step 1

Approximately every three months and during a period of down time, disconnect as applicable the RF transmitter and all power supplies. The main disconnect switch in the main load center box at the antenna site must be in the ON position and the detachable hand-held controller assembly must be plugged in.

Step 2

Open the outer local control/motor drive controller door at the antenna site to gain access to the conductors supplying power to the azimuth, elevation and polarization drive motors. Turn the primary power disconnect switch to the ON position.

Step 3

Turn the Az/EI speed switch to the FAST position. Turn the AZIMUTH EAST/WEST switch to either position and while the antenna is rotating, carefully use a clamp-on ammeter in accordance with the ammeter manufacturer's instructions to take current readings off each of the power conductors (phases) connected to the main terminal block at the bottom of the panel. Record the current draw in the equipment log and compare the readings to the reference values entered in the installation/acceptance check-off. If the readings differ significantly, refer to the appropriate troubleshooting information and perform the applicable corrective action. Then take voltage readings off each of the three conductors; the readings should agree with each other - within two percent. Turn the AZIMUTH switch to OFF.

Step 4

Repeat preceding step (3) with the AZIMUTH EAST/WEST switch in the alternate operating position.

- Step 5** Turn the ELEVATION DOWN/UP switch to either position and while the antenna is rotating, carefully use a clamp-on ammeter in accordance with the ammeter manufacturer's instructions to take current readings off each of the power conductors (phases) connected to the main terminal block at the bottom of the panel. Record the current draw in the equipment log and compare the readings to the reference values entered in the installation/acceptance check-off. If the readings differ significantly, refer to the appropriate troubleshooting information and perform the applicable corrective action. Then take voltage readings off each of the three conductors; the readings should agree with each other - within two percent. Turn the ELEVATION switch to OFF.
- Step 6** Repeat the preceding step (5) with the ELEVATION DOWN/UP switch in the alternate operating position.
- Step 7** Repeat steps 3 through 6 with the Az/EI speed in the SLOW position.
- Step 8** If all voltage and current readings are within tolerance, turn the primary power disconnect switch OFF. Then close and lock the outer local motor controller door. Disconnect the hand held controller to return antenna control to studio.

**Pedestal Mount
Bearing Pad
Adjustment**

The bearing pad (within the pedestal mount) adjustment rods/bolts require yearly adjustment and verification of torque value. With the antenna at zenith (90 degrees), follow the procedures presented below:

- Step 1** Loosen jam nuts on all rods/bolts.
- Step 2** Torque the upper adjustment rod evenly to 40-45 foot-pounds. Then torque the lower adjustment rod evenly to 40-45 foot-pounds.
- Step 3** Torque the upper adjustment bolt evenly to 40-45 foot-pounds. Then torque the lower adjustment bolt evenly to 40-45 foot-pounds.
- Step 4** Repeat steps 2 and 3 verifying all adjustment rods/bolts are evenly torqued within the limits specified.
- Step 5** Tighten the jam nuts.

Preservation of Component Parts

Aluminum Parts

When preserving component parts, refer to the following paragraphs in this section.

Remove all loose paint and corrosion by scraping, wire brushing or using steel wool. If using steel wool near the feed window, make sure that none remains on the feed horn window. Edges of existing paint can be blended with a metal surface by using a fine grit sandpaper. Wipe the surface to be painted with a soft rag dampened in trichlorethylene, lacquer thinner or equal. Be certain to remove all loose paint, corrosion, imbedded dirt, grease and oil deposits or the paint will not adhere to the surface. Lacquer thinner will dissolve paint if applied heavily and rubbed vigorously. The reflector may be washed with plain water if necessary. Do not use bleach, soap solutions or kerosene as it is difficult to remove the residue. Allow the cleaned surfaces to dry thoroughly before priming.

Prime the cleaned surface by applying zinc chromate primer. The primer can be applied with brush, roller or pressurized spray. If necessary, thin the primer with lacquer thinner to the proper consistency. Feather primer onto adjacent painted surfaces. Allow primer to thoroughly dry before applying the finish paint coat.

Paint all RF surfaces, such as the inside of the main reflector and subreflector with a high-reflectance white paint. This type of paint disperses light rays, reducing the focusing effect of the sun's radiation, thereby reducing heat build-up caused by the focused sun's rays on the feed system. Rear surfaces of the reflector and subreflector may be painted with a flat white enamel paint. The paint can be applied with a brush, roller or pressurized spray. If necessary, thin the paint with the appropriate thinner to the proper consistency. Thoroughly paint over the primed surfaces and blend with the existing painted surfaces.

Galvanized Surfaces

Remove all loose paint and corrosion by scraping, wire brushing or using steel wool. Edges of existing paint can be blended with the metal surface by using a fine grit sandpaper. Wipe the surface to be painted with a soft rag dampened in trichlorethylene, lacquer thinner, or equal. Be certain to remove all loose paint, corrosion, imbedded dirt, grease, and oil deposits or the paint will not adhere to the surface. Lacquer thinner will dissolve paint if applied heavily and rubbed vigorously. Do not use bleach, soap solutions or kerosene as it is difficult to remove these products' residue. Allow the clean surface to dry thoroughly before painting.

Paint the cleaned surface with a zinc-rich paint. The paint can be applied with a brush, roller or pressurized spray. If necessary, thin the paint with the appropriate thinner to the proper consistency.

Thoroughly paint over the cleaned surface and blend with the existing painted surface.

Lubrication

For long life and trouble-free operation be certain not to extend the lubrication schedule beyond the frequency recommended in Table 1. The frequency should be shortened if the antenna is subjected to an adverse environment (e.g. high temperature, extended periods of rainfall, high humidity, dust storms, etc.). Any component or part should be immediately be lubricated if, during inspection or operation, rough, jarring or intermittent motion is noted, or if squeaky or other unusual noises are heard. Lubrication is required on all metal-to-metal rolling or sliding parts. Use the lubricants recommended. Do not over lubricate. Over-lubrication can often be as damaging as under-lubrication. Prior to

the application of lubricant to any parts, use a clean cloth and/or bristle brush and remove any old lubricant to prevent an excessive build-up. Remove indicated access plugs from square tube weldment and apply lubricant to panning frame tube assembly and corresponding thrust pads. Securely replace access plugs in square tube weldment. Be certain to remove any protective caps and clean off each lubrication fitting prior to injecting fresh grease. The elevation and azimuth jackscrew assemblies are equipped with a grease fitting and corresponding pipe plug on opposite sides of the jack housing. Remove the appropriate pipe plug and fill it with grease until lubricant seeps from pipe plug opening. Replace and securely tighten pipe plug.

The following is a list of the lubricant characteristics:

- **Mobil Temp SHC32** A non-soap hydrocarbon fluid type grease. Operating temperature is -65 degrees to 350+ degrees Fahrenheit (-54 degrees to 177+ degrees Celsius).
- **Mobil SHC624** A low temperature synthetic oil for worm gear reducers. Operating temperature range is -40 degrees to 125+ degrees Fahrenheit (-40 degrees to 52+ degrees Celsius).
- **Moly Grease** A grease lubricant containing molybdenum disulfide. Operating Lubricant temperature range is -85 degrees to 300+ degrees Fahrenheit (-29 degrees to 149+ degrees Celsius).

Jackscrews/Motors

Periodically inspect lifting screws on jackscrew assemblies to insure adequate lubrication. Loosen jackscrew boot clamps to expose the lifting screw assembly. Fully extend jackscrew assembly, being careful not to exceed preset mechanical limits. Brush thin coating of Mobil SHC32 grease on exposed lifting screw. Replace boot and attach corresponding boot clamps. If lifting screw is rusty, remove existing lubricant with solvent and wire brush rusted area. Rinse with solvent and apply fresh grease.

Periodically inspect and remove dust and dirt deposits from the motor housings to avoid hindering the thread exchange with the ambient air. Slight dirt accumulation on the air vent screw through splash oil cannot be avoided, however, keep vent screw clean to ensure proper pressure compensation.

Lube points 2 and 4, shown in Table 1, require removal of the indicated drain plugs and collecting/measuring the amount of SHC624 drain oil using measuring cup. The specified amount of oil must be added to the gear motor/housing (after installing the drain plug) via the fill/vent plug opening using supplied funnel. Addition of the oil requires use of an appropriate filling utensil. Use of a modified level stick will not correctly gauge the appropriate amount of oil in the gear housings.

Gear Motor/Housing Fill Drain Requirements

Table 1. Antenna Lubrication Chart

Lube Point	Parts to be Lubricated	Action	Frequency	Service Type	Lube Type	Quantity/ Points	Andrew Number
1	Elevation jackscrew housing	Lubricate	Every 3 months	Pressure Fitting	SHC32	1	49208
2	Elevation gear motor housing fill and drain	Inspect Change	Monthly 3 months	Pipe plugs	SHC624	10 ounces	47497
3	Azimuth jackscrew housing	Lubricate	3 months	Pressure Fitting	SHC32	2	49208
4	Azimuth gear motor housing fill and drain	Inspect Change	Monthly 3 months	Pipe plugs	SHC624	10 ounces	47497
5	Panning frame tube assembly and thrust pads	Lubricate	3 months	Aerosol Spray	Dry Moly Lubricant	Surface Coverage	207911

Inspection requires checking for visible signs of oil leakage, draining, replacing and adding oil to ensure appropriate oil level requirements. Excessively dirty oil will require fresh replacement. If oil leakage is found to be excessive, refer to appropriate troubleshooting information and perform applicable corrective action. Periodic inspection procedures can be less frequent after first or second scheduled inspections.

Initial oil change requirements include flushing gear boxes with a standard cleaning agent.